Massachusetts Turnpike

5 Year Reconstruction and Improvement Program

Summary Report 1992

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Massachusetts Turnpike Authority
State Transportation Building
Suite 5170 - 10 Park Plaza
Boston, MA 02116

Re: Massachusetts Turnpike
5-Year Reconstruction and Improvement Program
Summary Report

Dear Members of the Board:

We are pleased to submit this summary report documenting the overall existing condition of the Massachusetts Turnpike and identifying the elements of a 5-Year Reconstruction and Improvement Program to meet the immediate needs of the Turnpike System. This document has been prepared as a summary and description of the volumes of engineering reports and maintenance records accumulated over the past decade which stand collectively as the basis upon which the determination has been made that the Authority must re-invest in this vital transportation resource.

The proposed 5-Year Reconstruction and Improvement Program for the Massachusetts Turnpike includes, among others, items that are essential to maintain the structural integrity and safe operation of the Turnpike System. The program is prudent; it is consistent with the types of programs initiated by other toll authorities; and it is a critical component in the Authority's efforts in protecting the substantial investment that has been made in this key transportation facility.

Respectfully submitted,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Gordon H. Slaney, Jr.
Partner

Massachusetts Turnpike

5 Year Reconstruction and Improvement Program

Summary Report

1992

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Introduction

Introduction

The Massachusetts Turnpike Authority operates facilities which are vital to the Commonwealth's overall transportation network. The Boston Business Journal recently called one of these facilities, the Massachusetts Turnpike, "...the most critical road in the state." The safe operation and maintenance of the Turnpike has a substantial impact on the states economic well-being and directly effects the quality of life of the citizens of the Commonwealth and the safety of millions of motorists who use the roadway each year.

The Massachusetts Turnpike Authority was established by the State Legislature in 1952 with the specific public mandate to construct, maintain and operate an express toll highway from the New York state line to a point or points in the City of Boston. As a financially independent public agency, the Authority's income is derived solely from tolls and other revenues generated by its users. These monies fully support the operation, maintenance, reconstruction , and policing of the highway. The Authority receives no state or federal funds of any kind.

Designed to the most advanced safety standards of its day, the Massachusetts Turnpike opened 123 miles of toll highway to service in 1957 and added a 12-mile extension connecting to Downtown Boston in 1965. The Turnpike includes 135 miles of mainline roadways, 260 bridges, 25 interchanges, 20 toll plazas, 3 police stations, 11 service areas and 6 maintenance facilities. Over the years, these facilities have supported and served hundreds of millions of motorists and millions of corporate and commercial carriers.

Today, the Turnpike faces a challenge of vital public interest. MassPike, like other toll roads around the country and major expressways of similar age and condition, faces the critical requirement of rebuilding for the future and assuring that reconstruction projects and essential operational improvements are undertaken and completed in a cost-effective and timely manner.

The Authority must protect the public's investment in the Turnpike highway system and the private investment of bond holders through prudent management and rehabilitation of this valuable public asset. As an important element of the Commonwealths transportation network, the Turnpike system must be rehabilitated if it is to continue to contribute to the Commonwealths economic well-being as it has over the past one-third century. The advancing age of MassPike facilities, combined with increased traffic and wear, make an accelerated program of capital investment at this time prudent and essential. Beyond the obvious public safety and operational benefits of an accelerated construction program, the program also provides a unique opportunity to create construction jobs to stimulate the Commonwealth's economic recovery.

The Massachusetts Turnpike Authority has always taken its public responsibility and stewardship of the highway system very seriously. Recognizing that portions of the Turnpike and its supporting facilities have reached or are approaching the end of their useful life, in 1989 the Authority publicly embarked on a ten-year reconstruction program aimed at ensuring the safe and efficient operation of the Turnpike system well into the 21st century. This initiative, summarized in a report entitled "Critical Needs for the 1990s", was the template for the Authority's long range capital planning and rehabilitation program. For MassPike, this comprehensive long range plan was an important first step toward providing a revitalized transportation corridor.

Following the successful initiation of this capital initiative, MassPike recently announced the second phase of its ten-year reconstruction program. This accelerated second phase will be accomplished over the next five years from 1993 to 1997. This timely and aggressive capital investment program addresses the immediate reconstruction, rehabilitation and improvement needs of the Turnpike system to bring them into conformance with current interstate highway safety standards and meet the needs of the motoring public for the future. It is essential to accelerate the reconstruction of these elements or face continued deterioration which will inevitably lead to higher reconstruction costs in the future.

MassPike's accelerated capital investment program is not unique. In fact, MassPike's program is similar in nature and scope to programs initiated by a number of state transportation agencies and toll authorities around the country faced with increasing traffic volumes and wear on aging highway facilities.

For example, in 1984 the Massachusetts Highway Department (MHD) undertook major reconstruction of the 9-mile Southeast Expressway, which had been constructed in 1957. At the time the Southeast Expressway was reconstructed, it was twenty-seven years old, or nearly a decade younger than the existing MassPike. The project involved the reconstruction of bridge decks, resurfacing, replacement of the drainage system, replacement of the highway signing and replacement of highway guardrail, lighting and median barrier; at a cost of approximately $65 million. Further, a number of toll highway authorities have also initiated major rehabilitation and improvement programs of similar magnitude and scope to the MassPikes reconstruction initiative. Table 1 outlines some of these programs.

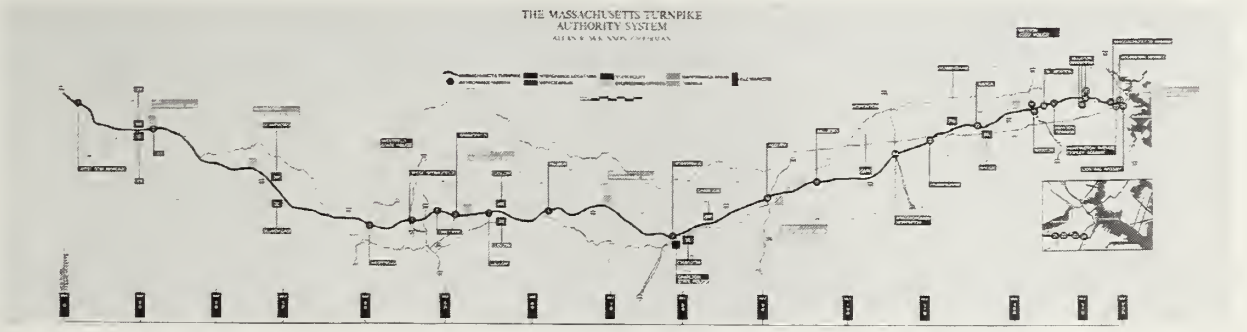
Table 1. Major Toll Facility Improvement Programs

Toll Facility	Year Constructed	Year Initiated	Program Duration	Program
N.H. Turnpike	1956	1986	10 Yrs.	$ 500 Mil.
N.Y. Thruway	1956	1988	8 Yrs.	$ 1.7 Bil.
N.J. Turnpike	1949	1988	10 Yrs.	$ 2.9 Bil.
PA Turnpike	1940	1986	10 Yrs.	$ 1.2 Bil.
Garden State Pkwy	1955	1990	5 Yrs.	$ 280 Mil.

The proposed 5-Year Reconstruction and Improvement Program has been divided into three general categories. These are: Public Safety and Operational Efficiencies, which are projects that are essential to protect the structural integrity or safety of the facility and those that are essential to enhance, or maintain the efficient operation of the Turnpike; Regulatory Requirements, which are projects that are required to comply with regulatory or statutory mandates; and, Initiatives, which are projects being undertaken to advance economic growth in the Commonwealth, improve the quality of life in communities along the Turnpike Corridor, and incorporate technological advancement to better serve MassPike patrons.

This document has been prepared as a summary and description of the volumes of engineering reports and maintenance records over the past decade which stand collectively as the basis upon which the determination has been made that the Authority must reinvest in this important transportation resource. Howard Needles Tammen and Bergendoff, acting as the Authority's consulting engineers, finds that the major components of the Turnpike system described as projects for Public Safety and Operational Efficiencies should be rehabilitated, replaced, or reconstructed on an accelerated basis to maintain acceptable standards of public safety and highway efficiency, in conformance with current AASHTO standards.

Figure 1. Massachusetts Turnpike System



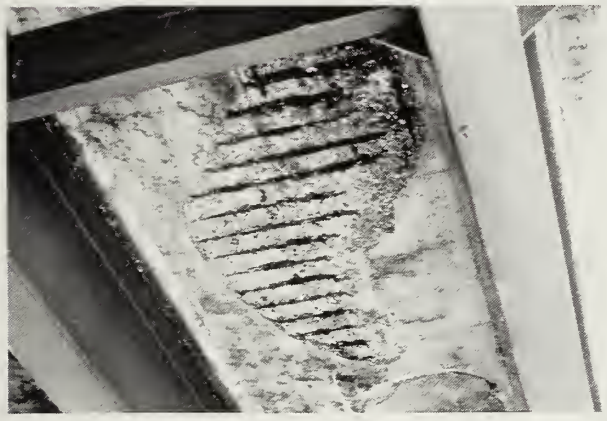
Public Safety and Operational Efficiencies

MassPike Bridges

The Massachusetts Turnpike Authority owns and maintains 260 bridges from Boston to the New York state line. Of these 260 bridges, 180 were built in the mid 1950s in only twenty (20) months during the time the first 123 miles of the Turnpike were being constructed. The balance of the bridges were built just a few years later in the 1960s along the Boston Extension. It's significant that the entire Turnpike system was built in such a short period of time, since essentially all the bridge decks of the Turnpike bridges are reaching the end of their useful life simultaneously.

Problems of age, increased traffic and heavier truck weights, combined with the effects of New England's weather, have resulted in deteriorated deck concrete and reinforcing steel. This condition is certainly not unique to the MassPike.

A U.S. Department of Transportation study has shown that approximately 59% of the nations 576,665 bridges are deficient. These structures are either structurally inadequate due to deterioration, fail to meet current design load criteria, or are obsolete as the result of changes in modern bridge standards. The problem of aging and worn bridges is even more focused and concentrated in New England and in Massachusetts due, in part, to the regions climate and exposure to freeze/thaw cycles.



Underside of Bridge Deck with Corroded Reinforcing Exposed

According to inventory data from the Massachusetts Highway Department (MHD), nearly 57% of the states 5,035 bridges are substandard. A total of 1,375 bridges (27%) are rated as needing immediate rehabilitation or replacement.

Response to the infrastructure crisis on both the national and local level has been severely hampered in recent years by limitations on funding. Public agencies have all too often implemented major infrastructure reconstruction programs following tragic accidents. For example, the State of Connecticut is in the midst of a $1.5 billion Infrastructure Renewal Program which was initiated following the catastrophic bridge deck failure several years ago on I-95 at the Mianus River Bridge. More recently, the City of Chicago has embarked on an aggressive infrastructure rehabilitation program following massive inner city flooding which knocked the city out of business for more than a week.

Bridge Ratings

MassPike bridges, although not weight restricted, are in need of a continued rehabilitation program. Every year all MassPike bridges are inspected by HNTB engineers and rated consistent with standard rating criteria as established by the Federal Highway Administration. The standard rating system used to rate the condition of MassPike bridges is consistent with the system used by the Commonwealth for state-owned bridges.

In general, bridge ratings run from a high score of 9 to a low score of 0. Each rating score corresponds to the following general description of conditions found at the time of inspection:

Table 2. Compiled Bridge Rating Descriptions

Rating	Bridge Condition	General Comments
9	New	Excellent Condition.
8	Very Good	No repairs needed.
7	Generally Good	Minor problems. Some maintenance required.
6	Fair/Satisfactory	Structural elements show minor deterioration. Maintenance required.
5	Generally Fair	Candidate for rehabilitation. May have section loss, cracking, spalling concrete.
4	Marginal/Poor	Major rehabilitation necessary. Advanced deterioration, spalling concrete, etc.
3	Poor/Serious	Rehabilitation required immediately. Deterioration seriously affecting primary bridge components.
2	Critical	Need for reconstruction urgent. Bridge should be monitored closely or closed until rehabilitation is complete.
1	Critical/Imminent Failure	Bridge closed until rehabilitated.
0	Critical/Failed	Bridge closed and is beyond repair.

Prior to summarizing the current ratings of bridges along the MassPike, it's important to highlight two facts regarding this standard bridge rating system.

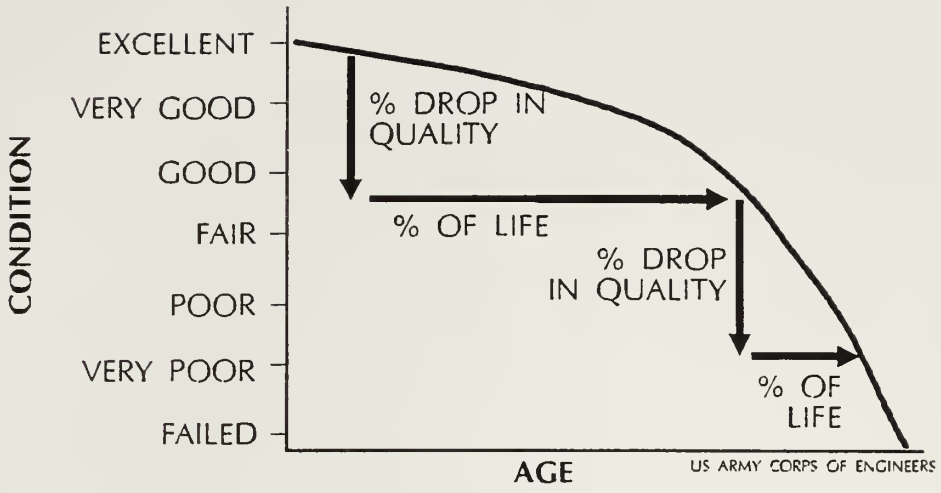
Typical Deck Deterioration
Marginal/Poor Condition (Category 4)

First, many elements of a bridge are individually inspected and rated prior to a bridge receiving a composite rating. For example, individual ratings are given such bridge elements as the deck wearing surface; deck condition above; deck condition below; bearing devices; paint; etc. Therefore each bridge element must be carefully assessed in determining the priority need for a bridge to be rehabilitated.

Secondly, bridges typically deteriorate at an exponential rate. While a bridge may be rated in Generally Good Condition (Category 7) or Fair/Satisfactory Condition (Category 6) and hold that rating for a decade or longer, once a bridge deck falls in the ratings to Generally Fair Condition (Category 5), which can be referred to as the "Trigger Point", it has been MassPike's experience that the bridge deck rarely holds that rating for more than four years before it falls to a rating of Marginal/Poor Condition (Category 4) or below.

The chart below, which is taken from information published by the US Army Corps of Engineers, shows graphically how an engineered structure, such as a bridge, deteriorates more rapidly as it ages.

Figure 2. Deterioration Curve



The phenomenon of exponential deck deterioration has recently been demonstrated in the case of MassPike's bridges. Once steel reinforcing rods begin to rust, expand, and crack the concrete, the corrosion accelerates substantially and leads to more rapid deterioration of the deck. Once bridge bearings do not bear properly due to corrosion, cracking and deterioration of the deck is aggravated. These and other signs of the progressive decline of the integrity of the MassPike bridge decks are evident throughout the Turnpike corridor and are documented in annual engineering inspection reports. For example, a review of those reports shows a rapid decline in several key bridge elements over the past seven years which is a trend fully consistent with the increasing age of the bridges and exponential deterioration which is common in facilities of this type and characterized by the Deterioration Curve.

Concrete Debris from Underside of Bridge Deck

The charts below are compiled from annual engineering inspections of the condition of the underside of the bridge decks (Deck-Condition Below) and clearly show that the structures on the Initial Turnpike are experiencing significant deterioration. In 1991, twenty-seven (27) were rated as Category 5. There is a cascading effect as bridges drop down the rating scale and are subsequently reconstructed and re-rated. Since these twenty seven (27) bridges rated as Category 5 are likely to be rated as Category 4 within a very few years, it's important to reflect on the dramatic number of bridges which have already fallen into a Category 4 rating over the past several years and, therefore, would be scheduled for reconstruction before these 27 structures. As shown in Figure 3A,

eighteen bridges on the Initial Turnpike were given a condition rating of Category 4 (Marginal/Poor) in 1985; whereas in 1991, seven years later, twenty-nine bridges (29) had fallen into the Marginal/Poor (Category 4) Condition. This is particularly significant since during this same period 51 bridge decks were replaced. This trend in bridge deck deterioration is demonstrated even more dramatically with an examination of the selected pool of those bridges which were rated Category 4 in 1991. (See Figure 3B). In this case only five (5) of those bridges rated as Category 4 in 1991 were rated a Category 4 in 1985.

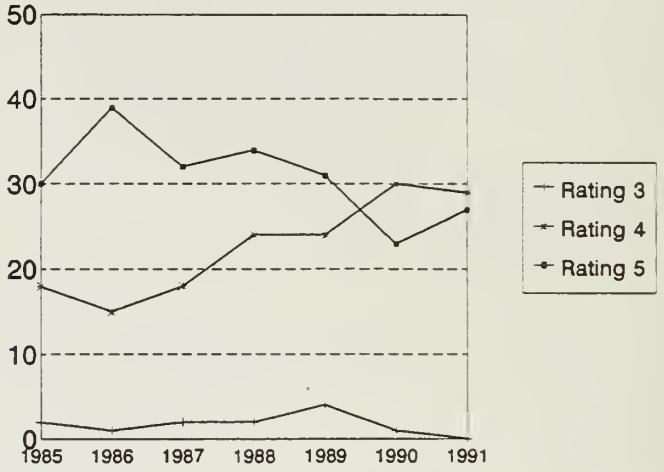


Figure 3A. Annual Inspection Ratings: Deck Condition Below Initial Turnpike - All Bridges

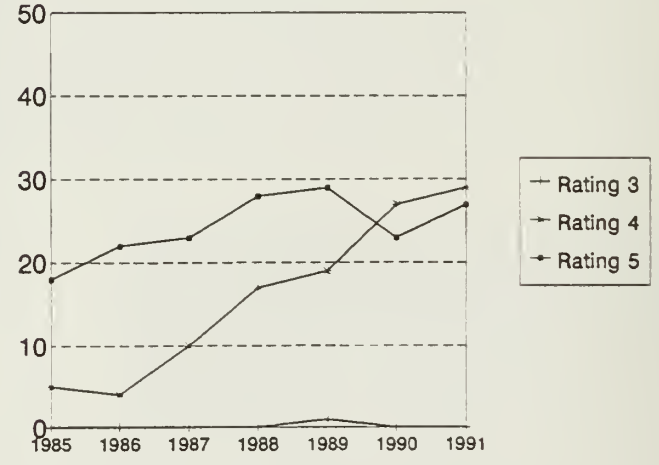


Figure 3B Annual Inspection Ratings: Deck Condition Below Initial Turnpike - Selected Pool

In the case of bridge bearings, while only ten (10) bridges on the Initial Turnpike were rated as Marginal/Poor Condition (Category 4) in 1985, twenty-nine (29) bridges received a rating of Marginal/Poor in 1991 (See Figure 4A). . As in the case of bridge deck deterioration, the trend in the condition of bridge bearings is even more dramatically demonstrated when looking at the selected pool of those bridges which were rated Category 4 in 1991 (See Figure 4B). In this case, only five (5) of those bridges were rated as Category 4 in 1985.

Of even greater concern is the fact that while no bridge bearings were rated as Serious/Poor (Category 3) in 1985, four (4) bridges fell in this category as of 1991

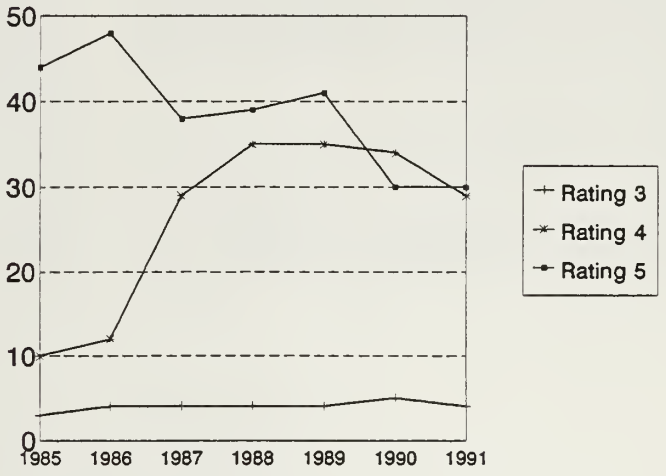


Figure 4A Annual Inspection Ratings:
Bearing Devices
Initial Turnpike - All Bridges

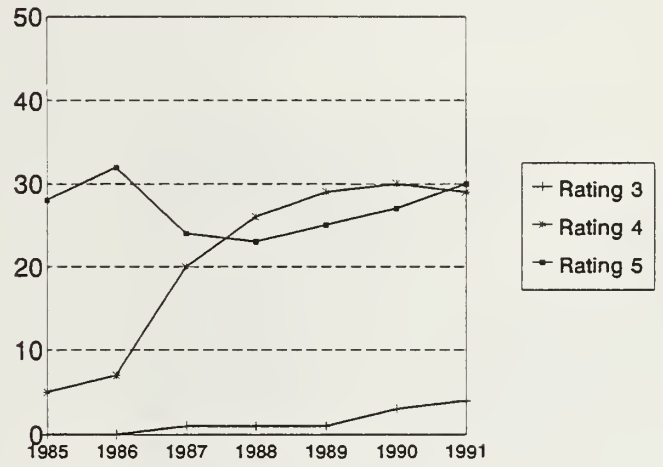


Figure 4B Annual Inspection Ratings:
Bearing Devices
Initial Turnpike - Selected Pool

Bridge Shielding

On New Years Day in 1990 a woman travelling along the Turnpike from Boston to the Berkshires narrowly escaped serious injury when a piece of the Oak Street bridge in Weston fell and crashed through the passenger side of her windshield. The impact caused her to lose control of her vehicle and consequently go off the road. Luckily she avoided serious injury, although her car ended up a total loss. Falling concrete has become a significant public safety risk as the Authority's bridge decks advance in age. These incidents pose a risk not only to millions of Turnpike motorists but also to local residents who must travel on local roads which run underneath Turnpike mainline bridges. Pieces of falling concrete vary in weight from a few pounds to several hundred pounds.

Typical Bridge Shielding Installation

Bridge Shielding Protecting Local Traffic

The chart shown on the following page shows the incidents of falling concrete which have occurred in the months of March, April, May, and June of 1992. MassPike maintenance records from mid-1988 to present indicate that falling concrete has occurred at more than fifty bridge locations. At the present time, a number of these bridges have been shielded with plywood by maintenance crews as a stop-gap measure to help minimize the chance of a serious accident.

Bridge Shielding and Deck Deterioration Closeup

Attached as Appendix I is a list of the MassPike bridge locations where shielding and/or emergency measures to remove falling concrete has been necessary. This dramatic increase in the number of shielded bridges and/or bridges with falling concrete is another example of the accelerated rate of deterioration in MassPike's infrastructure.

Emergency shielding like that used on the Turnpike is also quite common on bridges owned and operated by the Commonwealth and local communities. As recently as May 1992, the Massachusetts Highway Department sought bids for emergency shielding under the Route 152 bridge deck over Interstate 95 which was constructed in 1959-two years after the opening of the MassPike. However, while shielding a bridge is a prudent way to treat the symptom (falling concrete) it does nothing to correct the root cause of bridge deck failure, which is age, heavy use, and deterioration.

MassPike Bridge Program

In the case of the Massachusetts Turnpike, the deteriorating condition of the Turnpike bridges was foreseen in the late 1970s and a program was initiated to address the problem. During the past 15 years, 82 bridges (50% of the total requiring attention) on the Initial Turnpike

Table 3: Massachusetts Turnpike: Bridge Incident Log April - May 1992

Date	*Mile Marker East/West*	*Bridge*	*Description*	*Corrective Measures/Inspection*
3/26/92	132.9 EB	Boylston Street, Boston	Large piece of concrete (35 lbs.) fell from the expansion joint onto the right travel lane at skip line	Shielding installed EB & WB at all expansion joints
4/2/92	83.0 WB	Northside Turnpike, Charlton	Four (4) pieces of concrete fell onto the high speed lane & shoulder	All loose concrete chipped off - over lanes EB & WB
4/8/92	50.9 EB	Turnpike over Route 291, Chicopee	Large piece of concrete fell from parapet, break down lane, EB onto slope pavement of Route 291 North	Inspected and loose concrete removed
4/10/92	48.4 WB	Grafton-Granby Road, Chicopee	Preventive action - large concrete piece removed from corner of abutment, piece appeared to be about to fall on sidewalk	
4/13/92	79.2 EB	Route 49, Podunk Road, Charlton	Preventive action - removal of loose concrete that was about to fall	
4/14/92	131.0 EB to 131.5 EB	Viaduct at Beacon Park, Allston	Large piece of concrete (300 lbs) fell from EB expansion joint to rail yard below. report to Mass. State Police by Conrail Police	Inspected
4/16/92	8.3 WB	West Road, Lee	20 Pound piece of concrete fell on slope pavement from Westbound Roadway	Inspected
4/17/92	45.7 EB	Interchange 4 Ramp bridge	Bottom of bridge deck dripping water and cracked. deck is weak	Shielding Installed
4/22/92	131.0	Interchange 18 off ramp over Interchange 20 Inbound Ramp	4 Small pieces (6"x4"x3") fell onto median strip	Inspected
4/24/92	5.4 WB	Interlaken Road, Stockbridge	Concrete fell onto Slope Of Route 183 Below	
5/6/92	54.1 EB	Fuller Street, Ludlow	2-foot x 3-foot piece of concrete fell onto the Southbound Road	5 sheets of plywood installed as shielding
5/7/92	52.8 WB	West Street, Ludlow	Preventative Action	9 Sheets of plywood installed as shielding
6/1/92	126.6 WB	Commonwealth Ave., Auburndale	4 Small pieces fell from haunch to median & 4' shoulder of W. Broadway	Inspected. Loose concrete removed.

Substructure Deterioration at Bridge Abutment

by a concern for public safety and the discovery during the repair of certain bridge decks that deterioration had reached a state whereby repair was no longer economically or practically feasible.

From 1978 until 1992 the Authority replaced nearly one half of all bridge decks along the Initial Turnpike helped significantly by the Authority's accelerated ten year capital improvement program begun in 1990. As cited above, this accelerated program, "Critical Needs for the 1990s", had as one of its goals the replacement of all deteriorated bridge decks throughout the Turnpike system over a ten year period.

While much has been accomplished, much remains to be done. Appendix II includes excerpts from the 1991 Annual Inspection Report listing those bridges with a rating of Category 5 and below. One half of MassPike's bridge decks on the Initial Turnpike will reach 40 years of age over the next five years and remain to be reconstructed to avoid the problems which have been encountered by other public agencies responsible for major public infrastructure assets.

Slope Paving Failure

have been reconstructed; and 22 bridges (42% of the bridges requiring attention) on the Boston Extension have been rehabilitated.

The Authority began to see the earliest signs of accelerated bridge deck deterioration as far back as 1978. Prior to 1978, the Authority conducted an annual bridge deck repair program aimed at addressing extraordinary bridge maintenance needs which had become evident on many of the more heavily travelled turnpike bridge decks.

It was in the late 1970s when the Authority's repair program on the Initial Turnpike began to change direction from a repair program to a bridge deck reconstruction program. This change was necessitated

Example of Bridge Damage and Deterioration

Bridge Deck Replacement

Bridge deck replacement involves the complete removal of the existing reinforced concrete deck, including curbs, parapets and other elements; and the construction of a new reinforced concrete deck superstructure. Necessary repairs to the

Typical Slope Paving Undermining and Settlement (Substructure Repair)

substructure concrete and bridge bearing devices also are accomplished during reconstruction. Bridge joints are modified, drainage systems are repaired or altered and bridge approaches are reconstructed to reduce or eliminate some of the primary causes of bridge deterioration. To improve safety, new railings or concrete barriers and highway guard are added when bridge decks are reconstructed. The bridges structural steel also will be fully cleaned of existing lead-based paint and rust and painted with a lead-free system to protect the steel structure. For the bridges whose decks are not scheduled for replacement during this program, many will require less extensive repairs including repairs to the substructure concrete and bearings and cleaning and painting of the structural steel.

The Bridge Deck Replacement program does more than simply replace the deck; it incorporates improvements that enhance the safety and expected life of the bridges. In each case the deck replacement incorporates safety features, including bridge railings and Jersey-barrier shaped parapet walls and end attachments for highway guard conforming to current AASHTO standards and guidelines. In addition, improved construction materials and techniques, including high quality high-strength concrete, epoxy-coated reinforcing steel, waterproofing and special treatment of bridge deck joints, will significantly extend the life of the structures.

MassPike's Bridge Deck Replacement program is similar in nature and scope to the bridge reconstruction programs of the Massachusetts Highway Department and other turnpike systems which have been underway for the past few years. Between 1987 and 1992, 24 bridges on the Interstate system in Massachusetts - with an average age of 28 years - were reconstructed; and eleven additional bridges - with an average age of 34 years - have been programmed into the 1992/93 Program. On the Maine Turnpike, of 31 bridges replaced since 1978 the average age was 33 years. A study and report entitled "Timing for Bridge Replacement; Rehabilitation, and Maintenance" and presented in the Transportation Research Record, indicated that for the north region the mean of 121 bridges studied was less than 21 years before the first deck rehabilitation.

Bridge Deck Rehabilitation

Deterioration of the bridge decks on the Boston Extension, which is a few years younger than the Initial Turnpike, also has been increasing. MassPike maintenance crews continue to perform spot repairs. However, an expanded method of rehabilitation is needed. Over the years, many methods of repair have been used on Turnpike bridge decks. These different methods have been constantly evaluated to develop a system that has the best construction and serviceability characteristics. The current design evolved from this earlier experience and has been used for the last four or five years, and it is

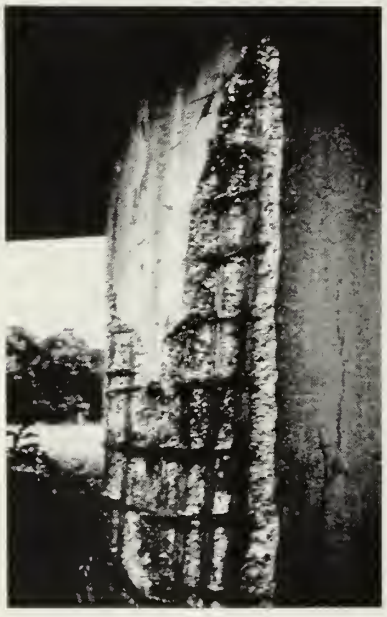
aimed at extending the useful life of these structures to the greatest extent possible.

Bridge deck rehabilitation currently involves the removal and replacement of generally the top four inches of concrete and the top layer of reinforcing steel. Repairs to structural elements such as bridge bearing devices, substructure concrete and joints are made where required; sidewalks and railings are repaired or replaced if necessary; anti-missile fencing is installed at locations where necessary; and the bridge approaches are resurfaced as part of the improvement work.

A priority for bridge deck rehabilitation on the Boston Extension has been established from the annual bridge inspection records. A continuation of the current bridge deck rehabilitation program can adequately maintain the integrity of the Boston Extension bridge decks beyond the year 2000. If these decks receive the recommended rehabilitation work in a timely manner, complete deck replacement of the type recommended on the Initial Turnpike should not be necessary for many bridges on the Boston Extension for some time in the future.

Substructure Rehabilitation

The substructure of numerous bridges, including the slope paving, drainage gutters, piers and abutments, are in critical need of improvement. In a number of instances, this need for reconstruction has become critical. The substructure elements of a bridge provide the foundation and support for the entire deck and superstructure, and while they generally are not visible to the travelling public, the structural integrity of these elements is absolutely essential to the safety of the structure. The Authority's maintenance forces are doing some essential repairs to deteriorated substructure concrete. However, the extent and number of locations where rehabilitation of substructure concrete is needed indicates that a more comprehensive and scheduled rehabilitation program is required in order to prevent further deterioration and damage.



Substructure Deterioration at Bridge Pier

As part of the bridge deck replacement and deck rehabilitation work, these substructure elements will be repaired on a priority basis and coordinated with other bridge reconstruction activities wherever possible. Substructure rehabilitation for those bridges that are not scheduled for deck replacement or rehabilitation, will be performed where required under separate contract. Failure to perform this work on an accelerated basis can result in a more rapid deterioration of the substructure and a dramatic escalation in the costs of the rehabilitation.

Underwater Substructure Repairs - River Bridges

Every five years an engineering inspection of the underwater portion of MassPike bridge piers and footings and the adjacent river bottom is performed on the thirteen (13) Turnpike structures that cross rivers. These structures include such MassPike bridges as the Westfield River Bridge, the Connecticut River Bridge, and the Chicopee River Bridge. This inspection is done in compliance with the requirements of the Federal Highway Administration. The importance of this inspection has been highlighted by the dramatic collapse of a bridge on the New York Thruway as the result of scour and undermining of a support pier, resulting in 10 fatalities and the closing of a segment of the Thruway for 9 months. It is quite common that certain repairs are required by the findings of these inspections in order to continue to ensure the structural integrity of these underwater supports. The next underwater inspection is scheduled for 1993 and, though the results of the inspection cannot be predicted at this time, allowance has been made in the five year capital program to address any deficiencies that may require MassPike's attention.

Bridge Bearing Replacement

Many of the bridges on the Turnpike have experienced deterioration of the bridge bearing devices that support the bridge superstructure as the result of corrosion, weathering and accumulations of grit around the devices and being subjected to roadway run-off containing salt.

Typically, when the decks of the bridges are rehabilitated or replaced, the bearing devices are also replaced, as required. In addition to the bridges included in the Bridge Deck Reconstruction and Rehabilitation Program, the bridge bearing devices that have deteriorated to the point that they require attention will be addressed separately in this project. Rehabilitation of these bearing devices is essential to ensure the continued structural integrity of the Turnpike bridges.

Bridge Bearing Tilted and Corroded

Review of bridge inspection records indicates that there has been a steady increase in the number of bridges having bearing devices with a condition rating of Category 5 or below. While only ten (10) bridges on the Initial Turnpike were rated as Marginal/Poor (Category 4) in 1985, twenty-nine (29) bridges received a rating of a Category 4 in 1991.

Clean and Paint Bridges

The primary purpose of paint on bridge structures is to protect the steel from corrosion and eventual failure. In order to protect the structural steel and to maintain a good appearance, the Authority initiated a program for the cleaning and painting of bridges in the early 1970s. Between 1972 and 1982 essentially all of the bridges on the Turnpike were cleaned and painted. The "conventional" paint system utilized on Turnpike bridges was a Basic Lead Chromate 4-coat system. Studies have documented that the estimated service life of this type of system is 10-15 years.

Corrosion of Structural Steel at Expansion Joint

In recent years, the effects of lead on the environment have resulted in federal, state and local pollution control requirements being enacted. These requirements have had a major impact on the procedures used in painting and paint removal. Paint removal is accomplished either by sandblasting, mechanical methods or solvent cleaning; and the new requirements are designed to protect the environment from resulting waste. The residue is considered hazardous waste and must be hauled to a legal hazardous waste site by a licensed carrier. These new requirements are having a very substantial effect on the cost of bridge painting.

The age of the paint systems applied in the earlier program is approaching twenty years old and has clearly exceeded the service life of the system. Currently there are 125 bridges with a paint system which is 15 years old or older; by the end of the proposed 5-Year Program, an additional 69 bridges will fall within this category. It is essential to initiate a new program for cleaning and painting to prevent further rust and corrosion and eventual damage to the structural steel from developing. The New York Thruway, which cleans and paints approximately 80 bridges per year based upon a 10-12 year life expectancy, has had to replace the entire structural steel superstructure of two of their bridges under their bridge reconstruction program due to extensive steel corrosion.

Corrosion of Structural Steel Resulting from Leakage through Deck

Bridges which are scheduled for Bridge Deck Replacement also will be cleaned and painted. Cleaning and painting for those bridges that are not scheduled for deck replacement will be performed on a priority basis under separate contract and coordinated with other bridge reconstruction activities wherever possible. Failure to perform this work on an accelerated basis can result in a more rapid deterioration of the structural steel and a dramatic escalation in the costs of the rehabilitation.

Bridge Anti-missile Fencing

Bridges carrying local roads over the Turnpike were typically designed and constructed with sidewalks. Because of the problem of objects being thrown from overhead bridges at passing motorists, various types of chain link fence have been added to bridges to help alleviate this potentially dangerous situation. During the past two years there have been numerous reported incidents of missiles thrown from overpasses and one fatality. The latest type of installations include an anti-missile fence, which consists of a vertical section of chain link fence and a top section which curves inward over the sidewalk.

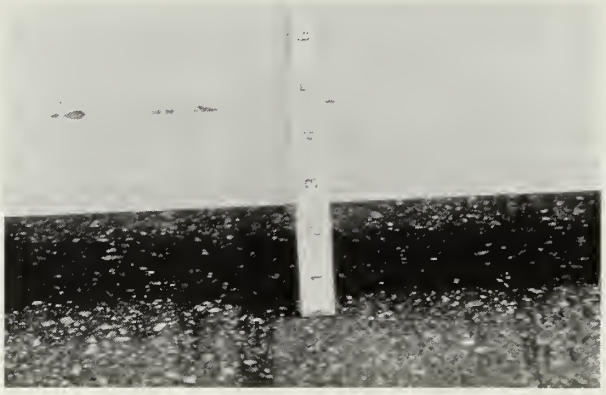
Most of the local road bridges over the Turnpike have been retrofitted with anti-missile type fencing as part of a fencing program or as part of bridge deck rehabilitation work. All Turnpike underpass bridge structures will be evaluated with respect to AASHTO "A Guide for Protective Screening of Overpass Structure" and prioritized for installation of anti-missile fencing as part of this Program. There are currently 26 bridges over the Initial Turnpike without anti-missile fencing. Two of these bridges are currently under design for deck replacement that will add the fencing. Sixteen of the remainder of the bridges without fencing (which are all on the Initial Turnpike) are considered priority locations and will be outfitted with anti-missile fencing over the next two years.

Pavement Repair, Resurfacing and Highway Guard Replacement

MassPike owns and maintains 135 miles of mainline roadways which represent 1,100 lane miles of pavement surface. Included, there are many miles of approach ramps and numerous acres of paved toll plazas. Increased traffic, heavier trucks, weather, and general age all contribute to the continuing deterioration of roadway surfaces. The number of trucks and cars using the Turnpike has grown dramatically from 10 million per year in 1957 to approximately 130 million - including 10 million trucks - in 1991. In short, the aging Turnpike is one of the most heavily travelled highways in New England and, not surprisingly, it has experienced a continuing and significant decline in pavement quality which must be addressed.

Pavement surfaces exposed to traffic wear and the elements eventually become brittle and develop cracks which allow the penetration of water into the subbase materials. This penetration of water, aggravated by freeze-thaw cycles and a pumping action, ultimately results in the deterioration and breakup of the pavement structure. This process of pavement deterioration tends to accelerate dramatically as the pavement becomes older and oxidizes. In addition, the continuous exposure to heavy traffic loads eventually causes rutting along the wheel tracks in each traffic lane. These ruts tend to fill with water and ice during inclement weather, causing vehicles to hydroplane and skid. The average life of bituminous concrete pavement varies considerably due to many factors including

Pavement Rutting - Mainline Roadways



3" Rutting in Wheel Path

the amount and type of traffic, level of groundwater, quality of the bituminous concrete mix, climatic conditions, type and depth of pavement substructures, and the type of terrain. In a report entitled, "Effects of Routine Maintenance Expenditure Level on Pavement Service Life" presented in the Transportation Research Record, a study of pavement service-life prediction models noted that in the northern regions, interstate overlaid pavements need resurfacing after approximately 10 years in order to retain an acceptable level of riding quality.

MassPike's schedule of pavement repair and resurfacing based on a twelve-year life cycle is proposed to maintain Turnpike pavements in a safe condition and to minimize the amount of pavement repair. This is even less conservative than some other toll authorities, such as the NY Thruway, the Pennsylvania Turnpike and the Kansas Turnpike, which assume a pavement overlay life expectancy of 7 to 10 years. The Massachusetts Highway Department has indicated that, based on its own experience and discussions with other DOTs in the Northeast region, the predicted life of a good quality bituminous overlay mix under highway conditions is between 12 and 15 years.

The pavement resurfacing program on the MassPike has divided the 135 miles of mainline roadways into individual pavement segments. Table 4 lists those segments, which have aged and deteriorated to a point where they should be rehabilitated and resurfaced over the next five years.

2" Deep Crack in 10 Year old Pavement

Table 4. Turnpike Pavement Resurfacing Program

Turnpike Segment (Mile Markers)	Year Scheduled	Year Last Resurfaced	Age @ Anticipated Resurfacing
36-48	1996	1981	15
48-58	1994	1979	15
58-68	1996	1985	11
68-79	1997	1984	13
98-111	1993	1970	23
111-121	1995	1978	17
123-127	1993	1982	11

Section of Highway Guard Needing Replacement

Resurfacing roadways provides an improved and safer riding surface for better stopping and good drainage to protect the roadway subsurface and produce a better surface for effective snow removal. A study of the effect of resurfacing on road safety found that regular resurfacing can improve safety by 20 percent. Resurfaced roadways are also more environmentally sensitive in that they require much less salt to be applied in order to maintain a safe driving surface. While the application of additional salt to prevent icing in wheel ruts is prudent from a safety standpoint, it is extremely costly from an environmental standpoint.

MassPike's ability to maintain its system of roads in good condition is important to all highway users and to the economic health of the Commonwealth. In a report prepared for the Construction Industries of Massachusetts it was noted that, according to data from the Highway Performance Monitoring System developed by the Federal Highway Administration, pavement conditions on main roads in Massachusetts have been deteriorating since the early 1980s to a point where nearly three-quarters of the miles being monitored are rated fair to poor. Roads in poor condition contribute to congestion and accidents, which the government says cost the country $120 billion a year - and uncounted lives.

Severely Corroded Highway Guard Post

Highway Guard

Roadside barrier systems, including cable guard, steel beam and concrete barrier, play a critical role in reducing the severity of highway accidents. Highway guard can protect a motorist from hazards along the roadway such as rock faces, steep slopes or fixed objects such as sign supports. Semi-rigid highway

guard systems, such as the steel beam system used along the Turnpike, have proven their effectiveness at saving lives and reducing injuries. Although most of the original highway guard on the Initial Turnpike has already been replaced, there are still thirty-five miles of the roadway where the highway guard should be replaced to further improve safety on the Turnpike. The existing program of safety upgrades and improvements incorporating current standards for highway guard will be continued in conjunction with the resurfacing program.

Lane Markings/Roadway Delineation

In order to improve visibility when it is dark, the width of pavement lane markings has been increased from 4 inches to 6 inches, and reflectorized pavement markers and demountable reflectorized highway guard delineators will be installed as part of each resurfacing project.

Pavement Repair and Resurfacing/ Prudential Passageway (Eastbound)

The eastbound and westbound roadways in the Prudential Passageway consist of a bituminous concrete overlay on a reinforced concrete base slab, which is the floor of the tunnel. Wear, exposure to the weather and freeze-thaw cycles, and the corrosive effects of de-icing salts has caused substantial deterioration and spalling of the underlying reinforced concrete base slab over large portions of the roadway. This base slab deterioration, combined with the extremely heavy traffic conditions on this section of the Turnpike, has caused the bituminous wearing surface to become severely deteriorated. Major portions of the base slab and wearing surface have been patched in an attempt to retain an acceptable riding surface. However, without major repair and rehabilitation of the reinforced concrete base slab, it will not be possible to provide a long-term stability to the riding surface of the roadway.

The resurfacing of the westbound passageway was completed in 1991. This westbound section had deteriorated significantly and required major rehabilitation. With similar conditions of advanced roadway deterioration in the eastbound portion of the passageway, this project will provide for the complete removal of the existing overlay, complete repair of the underlying concrete base slab, and the reinstallation of waterproofing and the bituminous concrete wearing surface of the Eastbound roadway.

Shoulder Rumble Strips

MassPike is annually rated as one of the safest toll roads in the nation based, in large measure, on its low rate of fatalities and accidents causing personal injuries. In an effort to build on this valuable record of accomplishment, MassPike will include in its capital program the introduction of rumble strips along the edge lines of the roadway at

both the inner and outer shoulders. This safety feature, made possible with pavement milling machinery, is scored into the pavement surface along the edge lines to warn errant drivers that they have left the travelled way. Rumble strips have been successfully used in several states including Pennsylvania, New York, and Florida.

This needed capital investment will directly address one of the leading causes of fatalities along the MassPike: driver fatigue. Since 1982, Massachusetts State Police records indicate that approximately thirty (30) percent of all fatal accidents on the MassPike were caused by the driver falling asleep at the wheel. These accidents took the lives of twenty-five operators and passengers. This analysis of ten years of records shows additional fatalities that were caused by inattention might also have been prevented by the installation of rumble strips. In the first four months of 1992 alone, there have been eight drift-off-road type accidents involving five fatalities on the Turnpike.

The Pennsylvania Turnpike Commission performed extensive off-road field testing of a system of shoulder grooves to awaken drivers who strayed from the travelled way, and its follow-up mainline pilot project in 1989 showed a dramatic reduction in drift-off-road accidents. Other agencies, including the Garden State Parkway in New Jersey, have also initiated programs and the New York Thruway Authority is implementing a Shoulder Treatment for Accident Reduction (STAR) program. Documentation of the findings of these pilot programs by both Pennsylvania and New York have indicated very significant positive results. In one test section on the New York Thruway, 20 reported "fell-asleep" accidents in a three-year period preceding the installation of the rumble strip was reduced to one in the first year following the installation. Implementation of the program on the Turnpike can improve safety and reduce the number of injuries and deaths.

Additional Emergency Breakdown Areas

The Boston Extension was generally constructed with inner and outer shoulders along the mainline roadway, which measure only 2 feet wide. As traffic continues to increase along the Extension, lack of storage space for disabled vehicles has resulted in severe traffic conditions, particularly during peak commuter hours. Records show that, over the past two years, MassPikes Emergency Service Patrol (ESP) has provided assistance to an average of over 570 disabled vehicles per month. On an annual basis there are nearly 7,000 vehicles disabled on the Extension, and that number can be expected to grow if traffic volumes increase.

Recognizing the need for additional emergency breakdown areas, the Turnpike began a program in the mid-1970s to construct lengths of breakdown lanes at intervals along the Extension, and that program was continued into the 1980s. These breakdown lanes have proven to be very beneficial, and additional emergency breakdown areas will be constructed to the extent practicable in order to provide motorists with additional locations where they can pull their disabled vehicle into a

safe refuge - off the mainline roadways - during emergency situations thereby minimizing traffic congestion and increasing the safety of the facility.

These additional breakdown lanes will be a very important component of MassPike's Emergency Incident Management Program during the MHD's Central Artery/Tunnel Project. Additional emergency breakdown areas on the Boston Extension will also contribute to the Commonwealth's compliance with the requirements of the Federal Clean Air Act by alleviating stand-still traffic that occurs when a disabled motorist blocks a travel lane due to a lack of emergency turn-off areas.

Rock Cuts

The original construction of the Turnpike involved cutting the roadway though sections of rock and ledge leaving large areas of rock and ledge immediately adjacent to breakdown lanes and travel lanes. Due to natural weathering (groundwater flow, freeze/thaw cycles, heavy plant growth, etc.) the rock slopes have, in some cases, become unstable and are in danger of falling onto the travel lanes of the Turnpike. The natural weathering and fracturing has been intensified as a result of the considerable blast damage incurred during construction. The blasting techniques which were utilized resulted in many areas of overbreak, open joints and seams, overhangs and shattered rock. Several significant rock falls have occurred since the original construction, and it has been necessary on numerous occasions to remove rock from the roadway travel surface and subsequently stabilize the slopes to alleviate more serious occurrences in the future.

Typical Rock Cut Section with Barrier Wall

MassPike maintenance logs show numerous incidents of rocks falling onto the travel surface, particularly following rain storms. Falling rocks pose a serious danger to motorists and has become extremely time consuming and costly for Turnpike maintenance forces, not to mention the danger posed to MassPike users. Appendix III is a recent maintenance log from the Auburn area which refers to the frequent occurrence of falling rocks. A dramatic example of what can occur if these ledges go unattended is shown in the following photo which took place along the MassPike several years ago. A program to clear the most critical areas of the falling rocks was initiated in the 1970s and over the past decade a number of locations have been addressed. In a further effort to reduce the potential that other incidents of this proportion do not occur in the future, in recent years MassPike has engaged the services of geotechnical specialists from the engineering firm of Haley and Aldrich to assess the integrity of various rock formations along the Turnpike corridor and to recommend a list of priority sites to be addressed over the next several years.

Rock Overhanging Barrier Wall

Rock Slide onto Turnpike Roadway

An engineering evaluation has been performed of thirty-nine (39) rock cuts along the eastern portion of the MassPike corridor to determine the condition of rock slopes and their potential hazard to motorists. This evaluation was conducted to assess the need for remedial work and to assign a priority to each of the slopes needing remediation based upon the Rockfall Hazard Rating System (RHRS) developed by the Oregon State Highway Department for the Federal Highway Administration. After careful consideration of each rock formation, the specific sites along the MassPike shown in Appendix IV have been identified as priority locations for remedial actions in order to maximize the safety of the millions of motorists who use the Turnpike annually. Sites rated below 175 points (Category C sites) on the RHRS system are not considered dangerous at this time and, therefore, will not be done over the next five years unless conditions change significantly. Other rock cuts ranking as high as 500 points (Category A sites) on the RHRS system will be prioritized and addressed expeditiously. The engineering analysis indicated that approximately thirty-four (34) of the rock slope sections of the thirty-nine (39) investigated had at least one area within the slope which poses a threat of rock fall onto the highway and require remediation as soon as funds can be made available.

Table 5. Rockfall Hazard Rating System/Preliminary Rating System

Criteria	Category		
	A	B	C
Historic Rockfall Activity	High	Moderate	Low
Estimated Potential for Rock on Roadway	High	Moderate	Low

Table 6. Rockfall Hazard Rating System/Summary Sheet

Category	Rating Criteria and Score			
	3 Points	9 Points	27 Points	81 Points
Slope Height	<25 ft.	25 to 35 ft.	35 to 45 ft.	>45 ft.
Ditch Effectiveness	Good Catchment	Moderate Catchment	Limited Catchment	No Catchment
Average Vehicle Risk	25% of the time	50% of the time	75% of the time	100% of the time
Percent of decision site distance	Adequate site distance; 100% of low design value	Moderate site distance; 80% of low design distance	Limited site distance; 60% of low design value	Very limited site distance; 40% of low design value
Roadway Width including paved shoulders	44ft.	35ft.	28ft.	20ft.
Structural Condition (Case I)	Discontinuous joints with a favorable orientation	Discontinuous joints with a random orientation	Discontinuous joints with an adverse orientation	Discontinuous joints with an adverse orientation
Risk Friction (Case I)	Rough, irregular	Undulating	Planar	Clay filling or slickensided
Structural Condition (Case I)	Few differential erosion features	Occasional erosion features	Many erosion features	Major erosion features
Difference in erosion rates	Small Difference	Moderate difference	Large difference	Extreme difference
Block site or quantity of rockfall per event	1 ft. or 3 cu. yds.	2ft. or 6 cu. yds.	3 ft. or 9 cu. yds.	4 ft. or 12 cu. yds.
Climate and presence of water on slope	Low to moderate precipitation; no freezing periods; no water on slope	Moderate precipitation or short freezing periods or intermittent water on slope	High precipitation or long freezing periods or continuous running water	High precipitation and long freezing periods or continuous water on slope and long freezing periods
Rockfall History	Few falls	Occasional falls	Many falls	Constant falls

To reduce the potential hazard of rocks falling onto the pavement - causing serious accidents and injury - some of the existing rock cuts must be cut back further from the edge of the roadways and cleared of loose rock. In each instance, unstable rock will be blasted and removed to create a fall zone which is a safe distance from the travelled way and consistent with generally accepted Interstate Highway guidelines.

Again, this program is not unique to the MassPike. Prior to 1988, the New York Thruway spent approximately $7 million per year addressing dangerous rock cuts. Following a fatality in 1988 which resulted from falling rock, the New York Thruway has spent approximately $40 million to address unstable rock sections at over 150 locations along the Thruway. In addition, the Pennsylvania Turnpike also has classified rock cut sections, and it is addressing the most critical areas as part of their annual construction program.

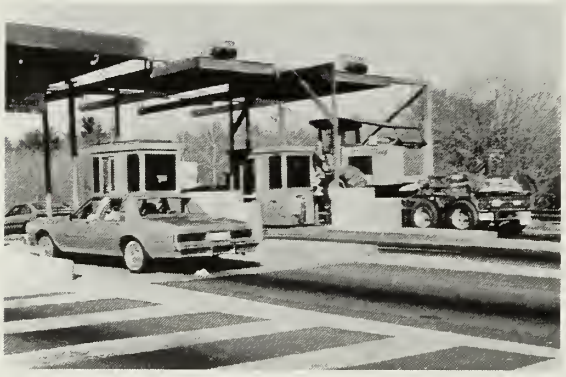
Highway Sign Replacement

Signing is an important element as it relates to regulation, warning, guidance, and directional information to the motoring public. It is essential that sign materials be used which will provide the best performance in all conditions. Current driving conditions and the volume of traffic on the Turnpike demand that the recognition and legibility of signs be maintained at a high standard of quality. High speeds and a growing population of elderly drivers requires greater recognition to allow ample time for decision making by the driver.

Studies have clearly documented that reflective sheeting deteriorates and will no longer provide recommended levels of reflectivity within 14 years. Leading manufacturers of reflective sheeting guarantee their encapsulated lens sheeting to have a useful life of 10 years. A major replacement of the highway signs on the Initial Turnpike was completed in the early 1970s. Due to their age, a number of the signs are no longer legible at safe and reasonable distances, particularly at night and during inclement weather. New reflective sheeting of the type used on the Turnpike has a minimum reflectivity reading of 45 candle-power, and the manufacturer warranties the material for 80% of this value (36 candle-power) for 10 years. Recent readings on sign panels installed in the mid-1970's indicate reflectivity values ranging from 80% to less than 60%. The signs on the Boston Extension were installed in 1965, prior to the issuance of the Manual on Uniform Traffic Control Devices. In the past two months there have also been some dramatic incidents of sign and sign support deterioration - and failures on the Extension. In one instance a sign panel separated from its bolted supporting attachment and had to be removed. In another instance an overhead cantilever mast/arm structure was found to be so badly corroded that it also had to be removed.

New signs will not only have better reflective sheeting but will also have new larger legend sizes and formats conforming to current signing standards. A 1988 report to Congress by the Federal Highway Administration stated that improvements in traffic signing have the highest benefit:cost ratio of any highway safety improvement. This signing upgrade and rehabilitation project is similar in nature and scope to the Massachusetts Highway Departments current and scheduled interstate highway improvement projects which include replacements of signing constructed in the late 1960s and early 1970s. One Massachusetts Highway Department project is currently underway on I-95 and five additional projects are scheduled for the next two years to replace and upgrade highway signs on the Interstate system in Massachusetts. Other toll road authorities also are involved in major sign replacement programs. The Kansas Turnpike is currently budgeting over $470,000 per year to replace old signs and bring the signing up to current standards, and the Oklahoma Turnpike is currently replacing all signs between 14 and 27 years old.

Over the next five years MassPike will replace guide sign panels with new aluminum panels, including all new sign supports on the Boston Extension, with the exception of those signs which will be replaced under the Central Artery/Tunnel (CA/T) Project. In addition, sign panels on the Initial Turnpike also will be replaced on a priority basis. Existing sign supports will be replaced where required.



Temporary Toll Facilities at Interchange 9

Rehabilitation of Toll Plaza Booths and Canopies

The toll plaza booths and canopies protect and house the Authority's toll collectors and computerized toll collection system. The adequate protection of personnel, computerized collection equipment and electrical systems is important to an effective and accurate toll collection operation. Leaks from aging canopy roofs cause thousands of dollars of damage to costly equipment and electrical wiring. This project provides for repairs to the canopy roofing, canopy drainage, replacement of various temporary elements of booths and canopies with permanent construction, painting of the steel toll booths and canopy framing, and replacement of the canopy lighting. Roofing repairs to the canopies will serve to minimize the exposure to leakage, to protect the Authority's substantial financial investment in toll collection equipment, and protect the structures from further corrosion and deterioration. The lighting system will be replaced and upgraded to provide for lighting to increase the level of security and safety of both the Authority's personnel and the motoring public.

Given that most of these elements are over thirty-five years old and the maintenance requirements are significantly increasing with age, implementation of the program is required at this time.

Tandem Toll Booths

Wheel Rut at Toll Plaza Lane

Pump Station Upgrade

It is not generally known that much of the drainage system for MassPikes Boston Extension is below sea level. Accordingly, five pump stations, several miles of underground drainage piping and more than two thousand catch basins, comprise an essential operating element of the entire eastern portion of the Boston Extension. In essence, this elaborate drainage and pumping system keeps the Boston Extension from flooding during heavy rainstorms, which would necessitate closing the road.

Each pump station is similar in design and equipment. The stations were designed and constructed in the 1960s and reflect that periods

technology, codes, and safety requirements. In an engineering report issued in February 1992 by the firm of Weston and Sampson, the Authority's capital needs were identified for each of the pump stations along the Boston Extension, including all mechanical, electrical, and structural elements. In short, the report detailed many critical needs that must be addressed expeditiously in several of the pump stations to ensure the safe and efficient operation of these important facilities.

Among the findings outlined in the report are: 1) the stations do not have dependable, automated pump controls and standby power capability; 2) telemetering for alarms do not exist; 3) there is a lack of proper heating and ventilation; 4) the lack of safety equipment at each station hinders proper and safe operation; 5) the need for updated electrical service is a major concern; 6) insulation has deteriorated with age; 7) the stations need to be rehabilitated to conform to current codes for dependable and efficient operation; and 8) concrete is spalling and deteriorating and requires major repair, etc.

Failure to modernize and rehabilitate these pump stations, which are over 27 years old, in a timely manner could cause significant operational problems in the future, including flooding along the Boston Extension corridor. Therefore, over the next five years rehabilitation efforts will include concrete repairs, building rehabilitation, replacement of doors and roofs, installing new heating, ventilation and emergency power systems and mechanical and pump repairs as required.

R.O.W. Fence Replacement

The entire Turnpike right-of-way was initially fenced with various types of fencing. The majority of fencing installed was 4-foot stock fence, however, in residential and business areas, 5-foot chain link fence was erected. Due to the age, condition, and lack of effectiveness of much of the existing right-of-way fence, extensive sections of the fence should now be replaced.

The Authority has replaced the deteriorated or damaged stock fence with modified chain link fence and replaced deteriorated or damaged chain link fence with new chain link fence in some areas under a program initiated in the 1970s. As areas continue to develop along the Turnpike right-of-way, it is increasingly important to upgrade and replace deteriorated fencing. Secure fencing will prevent indiscriminate or accidental entry, particularly by children, onto the Turnpike roadways, and it will protect the public from serious injury and the Turnpike from potential liabilities. All existing R.O.W. fence will be replaced within the limits of the resurfacing contracts. This project provides for the replacement of additional R.O.W. fence in priority areas outside of the limits of the resurfacing contracts, particularly where recent development has occurred.

The proposed fencing program is generally consistent with AASHTO Guidelines and the policy of the MHD that fences are placed along the location lines of all "No Access Highways". Stock fence will be

used in rural areas where there is a possibility of livestock and wildlife crossing the highway. Woven wire fence and chain link fence will usually be placed in suburban and urban areas as a deterrent to trespassing. The Design Standards note that judgement should be exercised when choosing a particular type of fence; considering population density, land use and practicality.

Replacement of Lighting System and Repainting of the Prudential Passageway

The goal of tunnel lighting is to provide for good driver visibility, both by day and by night, in order to allow the driver approaching the tunnel entrance portal during the daytime to overcome the "black hole" effect created by the high ratio of external to internal luminance. The Lighting Handbook of the Illuminating Engineers Society prescribes the current standards and criteria for accomplishing the goal of good driver visibility, and it defines the general guidelines for lighting levels through the approach, threshold zone, transition zone, and interior zone. This state-of-the-art treatment for tunnel lighting effectively eliminates the "curtain wall effect" on a drivers eyes as they transition from daylight into a tunnel.

The existing lighting system of the Prudential Passageway was installed when the Boston Extension was originally opened to traffic in 1965. Air-rights developments for Copley Place and the John Hancock Garage subsequently extended the existing system within the limits of the air-rights construction. The lighting system for the Passageway which evolved through the various stages of air-rights development has provided an acceptable level of lighting in the Passageway until recently, but it does not include proper transition lighting. Maintenance efforts have increased substantially in an attempt to maintain this acceptable level of service. Frequent inspections of the system have noted an increase of occurrences where fixtures are falling off the walls due to age and deterioration. Many of the elements of the system are outdated and have outlived their useful life. It is estimated that 60% of the lighting fixtures in the Passageway are broken and held together by temporary means. Increasing maintenance cost, substandard light levels, and lack of transitional lighting are all symptoms of an outdated, aging and deteriorating lighting system.

The proposed project provides for the complete replacement of all elements of the entire lighting system for both roadways and upgrade of the system to conform with state-of-the-art principles of tunnel lighting design. In addition, cracks and spalls in the walls of both Eastbound and Westbound roadways will also be repaired and the entire surface will be repainted. The improvements will greatly increase the lighting level for visibility on the roadway and improve the safety of the facility. In addition, a new lighting system will be more energy efficient and, combined with the reduction in maintenance, will quickly offset the initial cost of construction.

Fan Rooms Upgrade

Four fan rooms are located adjacent to the roadways in the Prudential Passageway to provide for the ventilation of vehicle exhausts out from the Passageway. Pairs of fans blow fresh air in the same direction as the flow of traffic for each roadway so that with free flow of traffic there is a natural piston-type of air flow that requires very little assistance from the fans. When traffic slows due to congestion or an accident or in the event of a fire in the Passageway, the fans are an important life-safety feature in providing an acceptable, safe level of air quality or facilitating emergency operations.

All of the equipment is original equipment that is maintained by Authority staff. According to industry guidelines, the types and sizes used in the Passageway fans and motors subjected to the conditions encountered have a life expectancy of 20-25 years. Recent annual inspections have noted that although the fans are working, most fans vibrate and are showing signs of aging and wear. The fan housing is rusting and gaskets between the fans housing and the ducts show some deterioration. Additionally, the rooms themselves are in need of general rehabilitation.

The condition and operations of the fans will undergo an engineering evaluation to determine the measures that should be taken to address current problems. The fans currently are operated manually at each location. The project also will provide for the addition of remote control of the fans from the Weston Maintenance Center. These controls can be very important in responding to emergencies. In addition, repairs to address the leaks, cracking and spalling in the concrete roofs and walls of the fan rooms will be included with the work.

Additional Snow Plow Ramps

The responsiveness and effectiveness with which MassPike's maintenance forces handle snow removal has become a hallmark of the Authority's entire organization and operation. As reported, the only major road to remain open (and clear) in the Commonwealth during the infamous "Blizzard of 78" was the Massachusetts Turnpike. Snow plowing operations on the Turnpike are handled by the Authority's Maintenance Sections, with each Section responsible for a designated segment of the mainline roadways and interchange ramps. Snow plow routes have been devised with overlapping turn-arounds at the end of each Maintenance Section so that there are no sections of roadway left unplowed.

At the time the Turnpike opened - and through the early years of operation - the snowplow turn-arounds utilized median crossovers to reverse direction. There are sixteen crossovers currently being utilized for snow plowing operations. With the increases in traffic on the Turnpike and increases in the size of equipment, use of the crossovers has become more and more hazardous. Snowplow ramps have been constructed to serve all maintenance sections east of Sturbridge. Traffic along the entire length of the Turnpike has now reached a point where use of median crossovers for snow plowing operations poses a safety

hazard. In the first 25 years of Turnpike operation, there was one accident involving snow fighting equipment utilizing median crossovers; in the last ten years there have been 13 accidents.

Under this project additional ramps will be constructed at additional locations to provide for a safer and more efficient means of allowing snow plows to make u-turns to complete their routes for snow removal operations. The addition of these snow plow ramps is essential to the continued safety of Turnpike operations and staff as well as to the motoring public.

Bin Wall Replacement

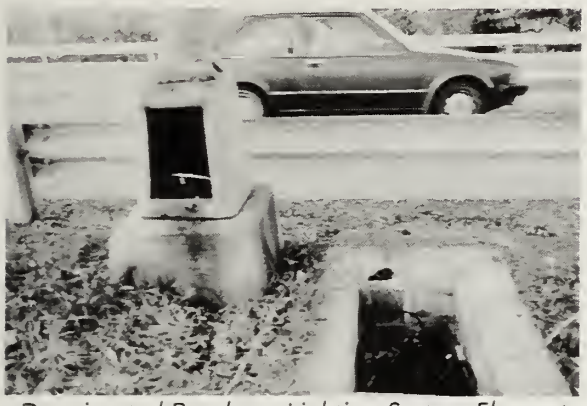
Metal Bin Wall with Temporary Repairs at Hudson Street (looking southeast)

During the construction of the Boston Extension, metal bin walls were used in some areas instead of reinforced concrete retaining walls to save time and construction costs in certain areas subject to predicted settlement due to unusual subsurface conditions. While the metal bin walls have performed well in maintaining the roadway embankments, the metal used in the walls has deteriorated and heavy corrosion has taken place. On March 1, 1989 the Authority was contacted by the City of Boston to clear and re-open Hudson Street of embankment material which had collapsed into the street after the metal bin wall had failed. On March 5, 1991 the Turnpike ramp from the Central Artery (SB) was closed to traffic as the result of a similar incident. In addition, walls at two other locations on the Boston Extension have had to be replaced.

Certain metal bin walls on the Boston Extension should be replaced at this time because of heavy rusting and corrosion. This corrosion creates holes which allow the fill materials to be washed out of the embankment. Metal bin type retaining walls at two locations on the Boston Extension are in need of repair or rehabilitation due to their deteriorated condition. One such wall, supporting Ramp F at Hudson Street at Interchange 24, is scheduled to be replaced under the Central Artery/Tunnel (CA/T) project. Its current condition, however, makes it necessary to make temporarily repairs to the wall until it is replaced. Additionally, three other sections of metal-bin walls supporting the Turnpike at Interchange 19, adjacent to Conrail tracks, will be rehabilitated. The proposed work includes shoring the embankment, and constructing new precast concrete retaining walls to ensure the stability of Turnpike roadway embankments and protection of adjacent property.

Metal Bin Wall at Hudson Street (looking north)

Replace Interchange Lighting Including Transformers



Deteriorated Roadway Lighting System Elements

Good visibility under day or night conditions is one of the fundamental requirements enabling motorists to travel on roadways in a safe and coordinated manner. Properly designed and maintained roadway lighting will produce comfortable and accurate visibility at night which will facilitate vehicular traffic. At interchanges it is desirable, and sometimes necessary, to provide interchange lighting. Drivers should be able to see not only the road ahead, but also the entire roadway area to properly discern the paths to be followed. They should also see all other vehicles that may influence their own behavior. The greater the volume of traffic, particularly merging traffic, the more important the lighting at interchanges becomes.

All interchanges on the Turnpike are illuminated. Illumination has proven to be very effective for increased safety in aiding drivers where ramp curvature and merging traffic conditions are experienced. Most of the lighting systems along the Initial Turnpike are original equipment installed prior to 1957, with the exception of Interchanges 4 and 11A which were constructed or reconstructed as new connections to the Interstate system and four interchanges where the luminaires, light standards, conduits and conductors have been replaced under construction contracts or by the Authority's maintenance forces.

Deteriorated Roadway Lighting with Temporary Exposed Wiring

In the past three years, the Authority's building maintenance crews have spent in excess of 170 person days each year to repair, rehabilitate and maintain the roadway lighting systems. Between Interchanges 1 and 12, at least 215 light standards are reported to be corroded or damaged and in need of replacement. The most critical element to the maintenance of the existing system is the conductors. Due to their age, there is an increasing demand on Turnpike maintenance to repair/replace conductors due to short-circuiting of the system. In many cases, maintenance is hampered by the fact that the bituminous fibre conduit, which was installed with the original construction, has become brittle and in many cases, has collapsed making replacement of the conductors in the existing conduit impossible. The existing light standards which are painted steel poles with a 30-foot mounting height, are a constant maintenance item and should be replaced by aluminum poles, and located along the ramps in conformance with current safety standards.

Although the system continues to function, in most cases the elements are obsolete and have exceeded their useful life, and the entire system should be replaced with a modern, more effective system. In addition,

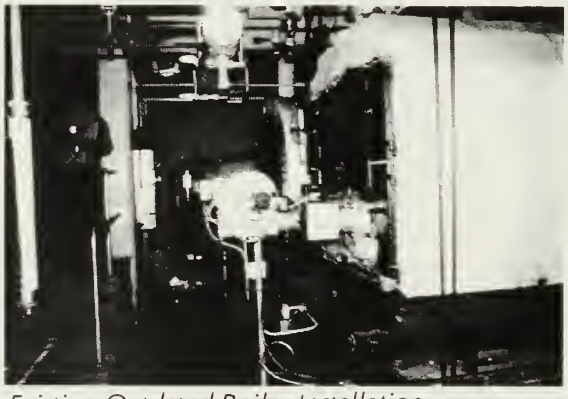
a new lighting system will be more energy efficient and, combined with the reduction in maintenance, will quickly offset the initial cost of construction.

Toll Plaza/Approach Improvements

The original design of the toll plazas anticipated future expansion for one or more lanes. As the result of extraordinary growth and changes in traffic patterns over the years, a number of the toll plazas have been expanded far beyond the provisions for future growth which had been designed into the facilities. As a result, ramp alignments at the approaches are no longer appropriate for the toll island configuration and traffic flows to and from the toll plaza is, in some cases, contorted, and maneuvering and merging is difficult.

This project provides for modifications to the configuration of the roadway/ramp approach to various toll plazas to be compatible with the current (expanded) toll plaza operation. At Interchange 11A, transactions have increased from 4.4 million in the first full year it was opened to traffic (1970) to approximately 13.2 million in 1991. Traffic is also continuing to increase at Interchange 13 and Interchange 1, and improvements are required to the approaches and toll plaza areas which are subject to peak hour traffic. At Interchange 11A the work will include the construction of additional toll islands and a new utility building in order to provide for an effective flow of traffic within the interchange ramps and to avoid encroachment into an Area of Critical Environmental Concern. In addition, modifications will be made to accommodate the increased staff which has been added to handle growing volumes of traffic. These toll plaza/ramp widenings and re-alignment of roadways/ramps will greatly improve traffic flows to and from the toll plazas and will result in more efficient utilization of the toll lanes and facilities, thus minimizing traffic backups onto the mainline of the Turnpike and traffic congestion.

Boiler and Emergency Generator Replacement



Existing Outdated Boiler Installation

The boiler and heating distribution systems in most of the maintenance buildings and police barracks will be replaced as they have exceeded their median life expectancy of 35 years. A few of the boilers already have been replaced out of necessity after they had failed and it was determined that they could not practically be repaired.

The emergency generators and transfer switches also will be replaced in many of these buildings since they have also exceeded their life expectancy. These emergency generators are especially important since they may be required for power for communications, State Police and Emergency Service Patrol Operations during storms and other emergencies.

Service Area Renovations

Eleven service areas are located along the Turnpike. Ten were built in conjunction with the construction of the Initial Turnpike, and one was built later in conjunction with Interstate Route 495. The service areas provide motorists with food, fuel and, in four locations, visitor information centers. While the restaurants have been renovated and new tanks and environmental controls have been installed at the gas stations, additional renovations, such as repaving and replacing the lighting systems, are necessary.

The proposed program will include repair and sealing of the existing pavement and repaving the entire area with a bituminous overlay. Other work items include repair of drainage structures, removal and resetting of edging and curb, and furnishing and installing new edging and curb where the existing curb has deteriorated. The repaving and recurbing effort will be based on plans to improve the parking layout for trucks, buses, and cars at many of the areas.

The lighting systems are, for the most part, 35 years old. Many of the elements of the system are outdated and have outlived their useful life. Maintenance has become difficult and, in some instances, is impractical due to the unavailability of replacement parts and unusable elements, such as collapsed conduit. The entire lighting system will be replaced with a modern, energy-efficient system.

Signage at the service areas is in need of upgrading and, in some areas, is deteriorating. Improvements will include new graphic communications at the areas and the installation of new signs. New signage will be part of an overall landscape plan, including improvements to all public areas as well.

As a result of a MassPike study, it was found that improvements could be made to the goods and services available, opportunities increased for the sale of commodities made in Massachusetts, and the information centers expanded to meet the needs of thousands of annual visitors.

Farmers markets are located at several of the areas in the summer. Improvements to the layout of the buildings and re-use of the empty gas station bays will include provisions for better facilities for the sale of Massachusetts products, such as those offered by the farmers, and better visitor information centers.

The service areas not only provide food and fuel to patrons, they are also an element of the Turnpike system which is a direct point of contact with the public and establish a strong image for motorists, many of whom form their first impression of Massachusetts when they stop at the areas closest to New York and Connecticut. In addition, service areas provide a refuge to patrons during storms and emergencies, as well as to relieve driver fatigue. It is not only critical that they be well-maintained, well-lit, and safe, but also that their potential for promoting economic development and tourism be maximized.

Beacon Park Rehabilitation

The Beacon Park Administration building at Interchange 19 was built with the construction of the Boston Extension in 1965. For a number of years it has served as the center for data processing and toll collection operations. This project provides for the relocation of Data Processing, complete removal of asbestos throughout the entire building, and the remodeling of the first and second floors to serve toll collection operations. Remodeling of the existing building has been assumed to include providing new floor tile, door and frames, suspended ceilings, lockers, provisions for persons with disabilities, modifications to existing walls, and lighting.

Upgrade Toll Plaza Buildings

With the exception of the Toll Plaza Buildings at Interchanges 4, 10, and 11A, all toll plaza buildings on the Initial Turnpike were built with the original construction; and they are over 35 years old. All of the mechanical and electrical systems, which have a median life expectancy of 30 years, have long outlived their useful lives; and they are in need of major renovation. The roofs of some of the utility buildings must be replaced due to their age and deteriorated condition. Windows and doors from the original construction are generally deteriorated and they should be replaced with modern energy efficient units. The walls and ceilings should be insulated to further reduce operating costs for these buildings. In addition, renovations to the existing locker rooms and the toilets to properly accommodate toll collection staff is necessary.

This renovation project will not only upgrade and extend the life of these Turnpike facilities by replacing elements which have outlived their useful life, but it will also provide an upgraded energy efficient working environment which will reduce operating costs and result in more effective Turnpike operations.

Maintenance Area Rehabilitation and Expansion

Most of the maintenance buildings on the Turnpike are over 35 years old. Their mechanical and electrical systems, which have a median life expectancy of 30 years, have long outlived their useful lives; and they are in need of major renovation. Some maintenance building roofs have already been replaced, and due to their age, the remaining roofs will also be replaced. The existing windows and doors are generally deteriorated, and they will be replaced with modern, energy efficient units. The walls and ceilings will be insulated to reduce operating costs for the buildings. The addition of female maintenance personnel along the entire length of the Turnpike necessitates renovations to the existing locker rooms and toilets to adequately accommodate staff with separate facilities.

Several of the maintenance buildings require expansion to provide storage of the modern, larger snow plowing equipment which is currently stored outside. Storage of this heavy equipment indoors will not only result in more effective maintenance operations, but it can help to extend the life of the equipment. These building expansions will also provide for greater efficiency of maintenance operations and a higher level of work place safety. Additional sand storage buildings will provide for more environmentally safe sand storage, and they can also result in greater efficiency and worker safety during road sanding operations.

This renovation project will not only upgrade and extend the life of these Turnpike facilities by replacing elements which have outlived their useful life, but it will also provide an upgraded, energy efficient working environment which can reduce operating costs and result in more effective Turnpike operations.

Materials Warehouse at Weston Maintenance Center

Due to the growing traffic volumes over the years and the Authority's efforts to enhance patron services, as well as the increased maintenance efforts for aging facilities, there have been increases in the scope and level of services provided by the Authority and a corresponding increase in its storage needs. A central materials warehouse to replace existing inadequate overcrowded facilities at the Weston Maintenance Area is currently being planned. This warehouse will provide for the storage of materials for the Authority's maintenance division, toll operations, State Police, and tourist information centers, as well as providing some improved stores administration space. Two smaller buildings now used for the storage of maintenance supplies will be replaced by the new facility. Approximately 50% of the materials currently being stored at these facilities are considered either hazardous or potentially toxic or capable of producing hazardous fumes in the event of a fire. Therefore, modern sprinkler and alarm systems will also be incorporated in the new facility. Construction of these facilities is appropriate and required to provide adequate storage facilities for hazardous materials both in terms of worker safety and protection of the environment.

Overcrowding at existing Weston Storage Facilities

Police Station Rehabilitation and Expansion

The Massachusetts Turnpike Authority State Police facilities no longer are adequate to meet the increased needs of a modern public safety operation. Mechanical systems are outdated, no adequate facilities exist to accommodate the needs of female troopers, prisoner holding cells do not meet current public health regulations, space is inadequate to properly handle bookings, finger printing, and a variety of other essential

police operations, and additional space is needed to address the needs of the State Police personnel who operate from these facilities 24 hours a day.

With the exception of the Weston Police Station, all of the police stations are over 35 years old. While work has been done on some of the boilers, the heat distribution systems are antiquated and need to be replaced. The windows and doors are generally deteriorated and they should be replaced with energy efficient units to help reduce the operating costs of these buildings.

Because of the increases in State Police personnel, the existing toilets and locker rooms are no longer adequate and should be expanded and renovated to provide for both men's and women's toilets and locker rooms. The existing roofs, floors, ceilings and kitchens at most of these barracks are quite old and also should be replaced. The existing prisoner holding cells cannot be used because they do not meet current Public Health Regulations. These cell areas will be inspected and renovated to conform to Public Health Regulations and to provide a safe and secure prisoner holding area.

In order to ensure a safe and efficient State Police operation, the Massachusetts Turnpike Authority's Five-Year Program will address the immediate needs of these police facilities.

Communication System Improvements

A fiber optic trunkline has been installed from the Authority's Tunnel Administration Building in East Boston to Mile 47 on the Turnpike mainline in the City of Chicopee. Cable containing 12 optical fibers has been spliced together to form a continuous line nearly 100 miles long. Under this project, the fiber optic trunkline will be extended to each of the Authority's facilities from Interchanges 14/15 in Weston to Interchange 3 in Westfield. The system will ultimately form the backbone of the Turnpikes emergency communications systems, and it will provide the Turnpike with high-quality and high-speed voice, data, video, and telephone communications required for the effective operation of the Turnpike, without the costs associated with conventional telephone lines. The fiber optic system also will enable the Authority to provide the Commonwealth access to the system for their communications needs.

Computer Improvements

The Authority's two mid-frame computer systems, which are used for financial applications and toll management, were installed in the mid-1970s. In addition, the existing software programs are 10-15 years old. Both the hardware and the software need to be replaced with more up-to-date computer technology. The current information systems are inefficient and expensive to operate and maintain, and they are not capable of providing information to management decision makers in a timely and useful manner. The Authority, having recognized the shortcomings of the existing systems,

retained the consulting firm of Coopers and Lybrand to prepare a comprehensive Information Technology Strategic Plan to address the Authority's future technological needs over the next five years.

The implementation of the Strategic Plan recommendations include the purchase of new client/server based computer software which will utilize the fiber optic cable and the PC resources within the Authority. Additionally, the implementation includes the development of packaged financial applications software, the development of new cost control and management systems, and the training of Authority personnel. By replacing existing financial management systems, introducing spatial data technology such as Geographical Information Systems (GIS) and implementing an incident management system, the Authority will be able to gain greater operating efficiencies and enhance management decision making.

Without moving forward at this time, the Authority will be forced to maintain and operate ineffective, costly and inefficient information systems which do not meet the current as well as future information needs of a modern day transportation agency.

Regulatory Requirements

Regulatory Compliance Program

The recent passage of the Americans with Disabilities Act, the 1990 Amendments to the Clean Air Act, and the expansion of environmental regulatory requirements governing the storage, use and release, or potential release, of oil or hazardous materials into the environment, and the strict liability provisions which are applied to owners of property, regardless of actual cause or responsibility, have, and will continue to significantly impact the types of projects and amount of Authority resources which must be dedicated to ensuring compliance with these various laws and regulations. Moreover, the costs of many of the operational activities undertaken by the Authority on a daily basis, such as the operation of public water supplies and sewerage systems at some of the Service Areas, Toll Plazas, and Maintenance Areas, have been significantly impacted by the stringent regulatory environment in which these activities must be carried out. The projects and activities identified below are those activities which will be undertaken over the next several years in order to ensure compliance with these laws and regulations. These projects are non-discretionary in nature, and in some cases, are being undertaken at the direction and subject to orders and approvals issued by the various state and federal regulatory agencies.

Phase II Comprehensive Site Assessment and Design and Construction of Remedial Systems for Twenty-Two Disposal Sites along the Turnpike Right-Of-Way

Pursuant to the requirements of Chapter 21E of the Massachusetts General Laws, and the regulations authorized by this statute, 310 CMR 40.00, also known as the Massachusetts Contingency Plan (MCP), the Department of Environmental Protection (DEP) must be notified in any case in which there is evidence of a release, or a potential release of oil or hazardous materials into the environment. The MCP sets forth specific requirements for the investigation of any such reported release, or potential release, and, if a release is confirmed, requires the DEP to undertake the assessment and remediation of the site where the release occurred. The DEP may order a party who, by the definition set forth in Chapter 21E, is "a responsible party" to undertake this work, subject to the DEP oversight and approval of all activities undertaken at the site. The definition of "responsible party" is not based on actual fault or causation, but in some cases is determined on the basis of a party's relationship to the disposal site (i.e. a party's status as owner, for example).

Maintenance Areas, State Police Stations and other Operational Support Facilities

Beginning in 1990, in compliance with revised state regulations in 527 CMR 9.00 and federal regulations in 40 CFR Part 280, the Authority undertook a comprehensive program for the removal and replacement of all underground petroleum storage tanks (USTs) and fuel dispensing systems at the maintenance areas, State Police stations and other operational support facilities. Upgrades to the fuel dispensing systems were undertaken to comply with the DEP mandated regulation 310 CMR 7 . During the tank removals, there was evidence that a release(s), or potential releases of oil or hazardous materials had occurred at these locations. Pursuant to the MCP, the DEP was notified of these findings and the Authority was required to undertake preliminary site investigations at these facilities.

Under the terms of the MCP, where releases have been confirmed to have occurred, the Authority will have to proceed with comprehensive site assessments and the design and construction of remedial systems. The Authority must undertake this work at twelve different locations throughout the state, spanning three state environmental regional offices. At the Maintenance Depot located in Blandford, MA, the Authority was ordered to undertake a short term remedial measure and such a system has been designed and implemented. The MCP requires that all work relative to the investigation, and implementation of a remedial measure at a confirmed disposal site be undertaken within seven years of the identification of the site by DEP. As such, the environmental work relative to the Authority's support facilities must be completed by, or about 1997 - 1998.

Service Areas

In the spring of 1990, the Authority undertook a limited preliminary investigation of site conditions at the eleven service areas on the Turnpike right-of-way relative to pending lease negotiations for a contractor to operate the service stations. A condition of this new lease was a requirement that the existing underground storage tank systems be replaced at these locations and stage II vapor recovery systems be installed. The preliminary findings from these limited investigations indicated that there had been releases of oil and hazardous materials at these locations, in varying degrees, as a result of the operation of the gasoline USTs and fuel dispensing systems by various oil companies over a thirty-five year period of time. The DEP was notified of these findings, and they issued Notices of Responsibility to the Authority as owner of these properties, and, in some cases, to the current and prior service station operators. As the owner of the property, Chapter 21E places this responsibility on the Authority regardless of the fact that the Authority never pumped gas at the service stations, or was otherwise directly involved in the operation of the service stations during this time period.

All eleven Service Areas are confirmed disposal sites. Two of the service areas have been identified as priority disposal sites and the Authority has been directed by DEP to undertake remedial measures at these locations. In addition, the Authority has been ordered to immediately undertake Phase II Comprehensive Site investigations at the two priority disposal sites. A proposed scope of work for one site is before the DEP for their review and approval. The second scope of work is in the process of being drafted. To date, the Authority has spent well over $3 million in costs associated with both the Authority's support facilities and the service areas. It is expected that the costs for assessment and remediation of the service area sites alone could exceed $14 million.

Underground Storage Tank

Underground Storage Tanks Removal and Replacement

The final phase of the Authority's UST removal and replacement program will be undertaken in the fall of 1992. At this time the remaining UST at the Beacon Park/Allston interchange will be removed and replaced pursuant to the requirements of the State Board of Fire Prevention Regulations, 527 CMR 9.00, and the MCP. In addition to the replacement of the UST, the fuel dispensing systems will be replaced in compliance with the Stage II Vapor Recovery program.

If this location is found to be a confirmed disposal site, the Authority will be required to undertaken assessment and remedial activities pursuant to the MCP, within seven years of the date upon which DEP identifies the site.

Replacement Water Supply for Service Areas 5E, 6W, and Charlton State Police Station, Charlton MA

The Authority presently owns and operates public water systems at two service areas located in Charlton (Service Area 5E and Service Area 6W) and at the State Police Station in Charlton. These facilities serve hundreds of thousands of Turnpike patrons each year. The operation of a public water system is governed by Massachusetts Code of Regulations 310 CMR 22.00, Drinking Water Regulations, which are administered by the Division of Water Supply of the DEP. The water supply for these facilities is generated from groundwater wells located at or adjacent to these properties.

At Service Area 5E two groundwater wells supply water to the service area facilities. One well provides potable water to the restaurant facilities, drinking water fountains and public restroom sinks. A second well provides water for nonpotable uses to the rest room facilities. At Service Area 6W, there is one groundwater well located off Stafford Street, northwest of the service area, which provides water

to the service area facilities. The Authority operates a water treatment facility at this location which treats the groundwater before it is used at the restaurant facility for drinking water purposes. Extensive water storage and pumping facilities must be maintained and operated at both service areas in order to keep pace with the water use demand at these facilities. At the Charlton State Police Station, a groundwater well on site provides water to this facility.

Historically, the groundwater supply at these Charlton facilities has presented both water quantity and water quality issues for the Authority. The groundwater content tends to be particularly high in certain metals, such as iron and manganese, which are naturally occurring elements in the subsurface. More recently, contaminants have been found in groundwater samples taken at the service areas and police stations, and as a result, the Division of Water Supply for the DEP has required the Authority to increase monitoring of the water from the water supply systems and has required the Authority to post information concerning the water quality at these locations. Because of limitations in the quantity of water which can be produced from the wells located at the service areas, in addition to increasing on-site water storage facilities, the Authority has had to have water brought to the service areas in tanker trucks to ensure an adequate supply during peak demand periods, especially in the summer.

In order to address both the regulatory water quality concerns and water quantity needs for these facilities, the Authority has in recent years investigated various alternatives to improve and upgrade the water systems. The various alternatives which have been considered include studies to identify the possible locations of new groundwater wells, increased treatment and storage capacity, and connecting to municipal water supplies in the vicinity. In order to provide dependable water supplies to the service areas of an adequate quantity and quality, the Authority has reached agreement with the Town of Southbridge for the Authority to construct a water main extension which will permit the Authority to connect these three facilities to the Town of Southbridge Municipal Water System.

Upgrade or Replacement of Wastewater Treatment Facilities at Service Area 6AW in Hopkinton, Service Areas 5E and 6W in Charlton, and Service Area 2W in Blandford

The Authority currently operates wastewater treatment facilities at four locations; Service Areas 6AW, Service Area 6W, Service Area 5E and Service Area 2W. The treatment facility at Service Area 2W also services the wastewater flow from Service Area 2E. Service Area 6AW is currently being connected to a municipal system. The treated wastewater effluent from the remaining plants discharge to intermittent surface waters. The plants operation and discharge limits are regulated and authorized by a National Pollutant Discharge Elimination System (NPDES) permit issued by the EPA, and a Surface Water Discharge permit issued by the DEP, Division of Water Pollution Control.

The permits for the facilities at Service Areas 2E/2W, 6W and 5E have expired and applications for new permits have been filed with the DEP and the federal Environmental Protection Agency. The permit applications are currently under review. Because of changes in the policies concerning surface discharges of treated wastewater, it is expected that the new permits when issued will have much stricter discharge quality requirements. These increased discharge quality standards will require that the existing wastewater treatment facilities be replaced with systems that are able to provide the higher level of treatment.

The Division of Water Pollution Control of the DEP has mandated that the existing treatment system for Service Area 2W be replaced and is in the process of setting the new effluent quality standards for the new treatment system. A new treatment facility is being designed and is scheduled for construction in 1993.

Asbestos Inventory and Management Program

Until the mid-1970s, asbestos was used extensively in building construction materials for insulation and fire protection. Asbestos has subsequently been identified as an extreme hazard to the health of persons exposed to airborne asbestos fibers. Federal and State programs have been initiated for the removal of asbestos containing materials (ACM's) from public buildings in order to eliminate human exposure to these materials. As ACM's are identified in Authority owned buildings these materials will be removed or remediated in an acceptable fashion.

The Authority is scheduled to undertake an audit of its facilities to identify the location of all ACM at any of its facilities including administrative facilities, toll plaza buildings, service areas, engineering facilities, maintenance areas, and police stations. In total, over 48 buildings or facilities will be audited. In addition, through on-going construction and repair work at certain of the Authority's toll facilities, ACM was identified and was removed and disposed of as conditions warranted.

Compliance with Clean Air Act

Traffic Management Systems

Various traffic management systems will be studied, tested and implemented as part of this program to maximize the efficiency and capacity of this critical highway facility to accommodate future traffic. Individual systems which will be considered include High-Occupancy Vehicles (HOV) Lanes, in-pavement vehicle detection, ramp metering, express lanes, and other traffic management systems. These projects are meant to supplement the successful programs previously initiated by the Authority such as the Interchange 11 car pool lot, HOV only Toll Booths at Interchange 19, and the Car Pool Pass Program.

These systems are critical to the Turnpikes future as they increase the vehicle handling capacity of the existing roadway without the need for constructing additional lanes. They have been included in this program to assist the Commonwealth of Massachusetts in achieving its goals of improving ambient air quality as required by the Clean Air Act Amendment of 1990.

It is also important to implement this portion of the program prior to traffic volumes returning to the levels experienced during the mid to late 1980s. Proper and timely implementation not only will prevent a return to previous levels of congestion, but is critical to the effective management of traffic coordination and cooperation with the MHDs Central Artery/Tunnel construction activities to minimize disruptions to traffic.

Electronic Toll and Traffic Management

Perhaps the most sweeping technological advancement in the toll industry in decades has been the introduction and evolution of electronic toll and traffic management (ETTM) systems. Existing ETTM technology allows tolls to be collected electronically and eliminates the need for motorists to stop and pay their tolls to a toll collector.

Implementation of this new technology on the MassPike will result in a number of positive benefits including, but not limited to, better traffic management, reduced operating costs, increased motorist convenience, improved ambient air quality, and reduced traffic congestion at toll plazas.

ETTM has successfully been fully implemented in Europe and in the United States on the Dallas North Tollway, the Oklahoma Turnpike, and on a number of toll bridge facilities. The technology has also been successfully tested on several other toll facilities throughout the country.

The implementation of an ETTM system along the MassPike in conjunction with other traffic management initiatives will allow the Turnpike system to handle future traffic volumes without needing to expand the existing roadway corridor. Further, ETTM can be creatively used to help promote the use of high occupancy vehicles and car pools on the Turnpike system.

It is important for the Authority to stay on its aggressive timetable to bring ETTM to the MassPike system in order to ensure that the advantages of this new technology are available through the height of the Central Artery/Tunnel Project construction as well as the full operation of the new Central Artery/Third Harbor Tunnel system. It is also important for the Authority to continue its leadership role in the New England ETTM Task Force to guarantee maximum compatibility amongst toll collection systems throughout the Northeast region.

Park & Ride Facilities

The Authority is committed to the development and implementation of innovative traffic management strategies to reduce congestion on the Turnpike as well as to advance the region's compliance with the Federal Clean Air Act. Several projects are under study or have already begun in order to meet the objectives of MassPike.

Park and Ride Lot at Interchange 11

Park and Ride Lots

MassPike constructed a park and ride lot at Interchange 11 in Millbury which was quickly expanded to meet demand from patrons wishing to commute by bus, carpools, and vanpools. Demand continues to outstrip supply, and MassPike is leasing additional land to accommodate additional motorists in that area. Because of the success of the venture in Millbury, MassPike is undertaking a study of the entire system to determine appropriate locations for additional surface lots.

Intermodal Facility

Several locations within the Route 495 area will be examined to determine the feasibility of constructing a parking garage with access to MBTA service, commuter rail or express buses to downtown Boston.

Golden Triangle Ramp

In addition to surface lots throughout the system and an intermodal facility, the possibility exists for MassPike to participate in an interagency project at Interchange 13 in Framingham. This interchange is a major access point for commuters. An existing bus terminal located in the area could serve as a park and ride location for drivers who would leave their cars and travel to Boston by bus. The facility would be most efficient if there were direct access to the Turnpike for the buses. MassPike acquired an abandoned railroad right-of-way which could accommodate the layout of a ramp directly from the bus terminal to the Turnpike eastbound. This project provides for the construction of the ramp, including earthwork, grading, paving, signing, and fencing. Provisions for operations within the toll collection systems will have to be studied and resolved. The project depends on cooperation with MassPort and the Executive Office of Transportation and Construction, as well as local acceptance.

Initiatives

Initiatives

The following Initiatives projects have been identified as critical by the Authority to the Authoritys objectives to support economic growth and contribute to improving the quality of the environment through transportation projects.

Interchange with Route 146

Perhaps one of the most important regional transportation initiatives in the Commonwealth at this time is the construction of a new MassPike interchange with Route 146 in the Millbury area and the upgrading of several miles of Route 146 to accommodate the new connection. This cooperative effort between MassPike and the Massachusetts Highway Department is essential to the future economic health and prosperity of the City of Worcester and the entire Blackstone Valley region.

Proposed Interchange with Route 146 for Worcester/Millbury

In order to ensure that this project remains a high priority and is constructed on an accelerated basis, MassPike and the Massachusetts Highway Department have entered into a unique Memorandum of Understanding to advance the project. At the present time MassPike is funding the completion of the environmental review documentation and the preliminary design of the entire project. Once final plans are approved, MassPike will fund the complete cost of constructing the new interchange which will connect to the MHD funded portion of the project along Route 146.

Securing sufficient capital funds will be key to the Authority's ability to undertake this important regional transportation initiative.

Economic Development Initiatives

Turnpike access provides the potential to open up areas for economic development while alleviating local traffic problems. MassPike has undertaken several studies of its real estate assets to determine their economic development potential and how Turnpike improvements could enhance their value. In addition, MassPike is cognizant of the importance of shipping to the economy of the state and region and is exploring prospects for improving facilities for truckers using the Turnpike.

Air Rights

A study of Turnpike air-rights in Boston and Brookline indicates potential for several development projects, including a parking garage to serve the Fenway and Longwood Medical Area institutions, alleviating traffic congestion in the neighborhood. The project could include direct access from the Turnpike to the garage, and studies will continue to determine the engineering and financial feasibility of the project, as well as its place in the City's transportation and economic development plans.

Allston Landing

A second study is examining the potential for transportation improvements in conjunction with the development of space for research and development in the Allston area of Boston. To facilitate such development, expenditure on infrastructure improvements, including new access ramps, would be required. As with the air rights, the Allston project would also benefit from intermodal opportunities. In each case, an economic development infrastructure program will not be fully identified before 1994.

Truck Stop

A third project examines the feasibility of providing better facilities for truckers with direct access from the Turnpike. MassPike has completed a survey of truckers, undertaken and engineering feasibility study of several sites it owns, and will complete a study of options in 1992.

Traffic Management Advisory Systems

Variable message signs provide "real-time" roadway information to motorists of accidents, congestion and construction and maintenance activities. Located one to two miles in advance of key interchanges, variable messages signs would provide real-time information to motorists advising use of alternate routes if necessary. Signs have already been installed on the Boston Extension at the approaches to the Prudential Passageway.

Under this project the signs will be installed on Route 128/NB & SB and on the Turnpike in advance of Interchange 14/15 (four locations total). This project will be extremely beneficial with the cooperative/joint efforts of the Authority and the MHD in managing the traffic flows and minimizing disruptions during the construction of MHDs Central Artery/Tunnel Project.

Noise Barriers

The Federal Highway Administration (FHWA) defines two types of projects for which noise abatement studies are conducted. Type I projects refer to the construction of a highway on a new location or the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment or increases the number of through-traffic lanes. Type II projects refer to providing noise abatement on existing highways.

In response to increased concern over the existing noise levels experienced by individuals and communities adjacent to the Turnpike, a comprehensive noise barrier program is being implemented. The ongoing development of a Type II program includes establishing guidelines from which to evaluate the need for noise barriers at various communities along the Turnpike. The Authority has hired a consultant to develop these guidelines, provide a priority ranking for those communities where noise barriers are needed and design the appropriate barriers. Community involvement, a critical element in the design process will be incorporated throughout the design process.

The construction of pilot noise barriers at three sites is scheduled for 1993. Under this project, the construction of additional noise barriers will continue based on the priority listing developed as part of the program.

Conclusions

Conclusions

The Turnpike is part of the National System of Interstate roadways which has received substantial media coverage in the last several years. Serious and often tragic bridge and highway failures capture the public attention. But the real and silent issue for many highways is one of increasing age and continuing neglect because of budgetary constraints. Within this national atmosphere of deteriorating roadways and bridges, the Authority's program of maintenance has kept the Turnpike in generally good repair; but it is apparent that the maintenance program alone it not expected to be able to work quickly enough to compensate for increasing wear and aging of Turnpike facilities. Major issues of public safety present a compelling need.

Since 1981, the Massachusetts Turnpike Authority has undertaken more than $279 million of highway construction projects. On March 1, 1990 the Massachusetts Turnpike Authority increased tolls in order to implement the recommendations of the Critical Needs Study and to accelerate the Turnpike's repair and rehabilitation programs. As a result, the Authority initiated a significant amount of construction during 1990 and 1991. The level of funding established for the 1992 Replacement Reserve and Improvement Programs can only meet the short-term needs of the Turnpike System. Future funding levels should reflect amounts necessary for the successful completion of the Authority's Critical Needs Program within an acceptable time frame.

To meet the challenges of the next five years and beyond, the Turnpike Authority should significantly increase recent efforts to accomplish construction and maintenance projects that directly impact public safety and highway efficiency. Sound management practices have kept the Authority's budget in balance and an excellent program of maintenance has kept the highway in generally good repair. But the effort to maintain a safe and efficient highway is losing ground to the growing needs of an aging highway. At the current level of construction funding, the Turnpike Authority cannot hope to keep up with required construction over the next five years if the Massachusetts Turnpike is to meet the needs of Massachusetts as well as the needs of the Commonwealth's future economy.

The proposed 5-Year Reconstruction and Improvement Program for the Massachusetts Turnpike includes items that are essential to maintain the structural integrity and safe operation of the Turnpike System. The program is prudent; it is consistent with the types of programs initiated by other toll authorities; and it is vital to protect the Authority's investment. Necessary repair and construction projects are located along the length of the highway. Approximately 40% of these needed projects are located from Boston to Route 495 and 60% are located west of Route 495 to the Berkshires. This program is part of a comprehensive plan to upgrade the condition and maintain the safe operation of the Massachusetts Turnpike so that it will continue to meet the transportation needs of the Commonwealth and the region into the 21st century.

Appendix

Appendix I

Bridge Condition Report
Falling Concrete / Shielding

BRIDGE		BRIDGE	
18.4 MM	Werden Cross Road*	93.6 MM	Greenwood Street
36.2 MM	Rte. 20 & Westfield River*/**	104.9 MM	Wood Street
49.2 MM	Route 33***	110.2 MM	Oak Hill Road
45.7 MM	Interchange 4	111.2 MM	I/C12 over Mainline
50.9 MM	Interstate 291	113.2 MM	Pleasant Street
4.5 MM	Route 102	113.5 MM	Grove Street**
12.2 MM	Chestnut Street	111.5 MM	Route 9
40.2 MM	Lockhouse Road	116.6 MM	I/C 13 over Mainline
48.39 MM	Grattan Street/Granby Road	116.6 MM	I/C 13 over Speen St.
52.8 MM	West Street	116.4 MM	Railroad
54.3 MM	North Street	112.9 MM	Temple Street
55.2 MM	Chaplin Street	118.9 MM	Oak Street
56.9 MM	Miller Street	122.0 MM	Oak Street**
76.5 MM	Cedar Street	120.7 MM	Winter Street**
69.9 MM	Brimfield Road	124.1 MM	Woodland Road
72.6 MM	Brookfield Road	123.9 MM	Structure #11 (I/C 24 ramp over ramp A)
75.4 MM	Clark Road***		
74.9 MM	Brookfield Road***	131.6 MM	Comonwealth Avenue
75.9 MM	Arnold Street***	130.0 MM	Everett Street
79.2 MM	Podunk Road	125.4 MM	Highland Street
89.0 MM	West Street	---------	Copley Square Off Ramp
94.0 MM	Route 146	127.0 MM	Lewis Terrace
95.3 MM	Millbury Avenue	129.2 MM	North Beacon Street
95.9 MM	Wheelock Avenue	129.0 MM	Parson Street
91.4 MM	Central Street	132.8 MM	Massachusetts Avenue**

*Reconstructed in 1990 ** Reconstructed in 1991 *** Reconstructed in 1992

Appendix IIA

List of Bridge Ratings - Category 4 and Below

(Excerpt from the Executive Summary section of HNTB's 1991 Annual Inspection Report)

General

The inspection of the Turnpike facilities indicate that the Massachusetts Turnpike continues to be operated in an efficient and effective manner and has been maintained in generally good repair, working order and condition. The Turnpike presents a generally good appearance through the continued efforts of the Authority's maintenance forces. However, it is becoming increasingly evident that many of the Turnpike's bridge decks, sections of the roadway riding surface and support facilities are approaching the end of their useful lives, thereby requiring an increased amount of maintenance and rehabilitation.

Bridges

The bridges, including piers, abutments, bridge steel, concrete decks, safety walks and appurtenances were inspected and found to be in generally fair to poor condition. Although many of the structures show no major defects, a large number have experienced deterioration of their concrete substructures and decks. Also, though for most part, not highlighted in this Summary, the paint on many of the Turnpike bridges is reaching the end of its useful life. Repairs that were rated Catagory 3 and 4 include the following:

Compiled Bridge Rating Descriptions

In general, bridge ratings run from a high score of 9 to a low score of 0. Each rating score corresponds to the following general description of conditions found at the time of inspection:

Rating	Bridge Condition	General Comments
9	New	Excellent Condition.
8	Very Good	No repairs needed.
7	Generally Good	Minor problems. Some maintenance required.
6	Fair/Satisfactory	Structural elements show minor deterioration. Maintenance required.
5	Generally Fair	Candidate for rehabilitation. May have section loss, cracking, spalling concrete.
4	Marginal/Poor	Major rehabilitation necessary. Advanced deterioration, spalling concrete, etc.
3	Poor/Serious	Rehabilitation required immediately. Deterioration seriously affecting primary bridge components.
2	Critical	Need for reconstruction urgent. Bridge should be monitored closely or closed until rehabilitation is complete.
1	Critical/Imminent Failure	Bridge closed until rehabilitated.
0	Critical/Failed	Bridge closed and is beyond repair.

MM	Structure #	Structure Name	Item	Repair
1.30	*A-2*	*Baker St.*		
		Deck	Condition Above	4 E
		Deck	Condition Below	4 E
4.50	*A-20A*	*Rte. 102*		
		Deck	Drains	3 M
		Deck	Deck Joints	4 E
		Super	Bearing Devices	4 E
		Sub	Piers - Caps	4 E
5.40	*A-7*	*Interlaken Rd. (Rte. 183)*		
		Deck	Wearing Surface	4 E
		Deck	Condition Below	4 E
		Super	Bearing Devices	3 E
7.50	*A-9*	*East St. (Rte. 7)*		
		Deck	Condition Below	4 E
		Super	Bearing Devices	4 E
		Sub	Piers - Caps	4 E
		Sub	Slope Pavement	4 E
8.30	*A-10*	*West Rd.*		
		Deck	Wearing Surface	4 E
		Deck	Condition Below	4 E
		Super	Bearing Devices	4 E
9.40	*A-12*	*Fairview St.*		
		Sub	Piers - Caps	4 E
9.70	*A-13*	*N.Y.N.H.&H.R.R. Quarry Rd.*		
		Sub	Piers - Settlement	4 E
10.30	*A-15*	*Housatonic River (Rte. 20)*		
		Deck	Wearing Surface	4 E
		Deck	Condition Below	4 E
		Deck	Parapet	4 E
10.40	*A-20*	*Housatonic St. (Ramp)*		
		Super	Steel Work	4 E
		Super	Collision Damage	3 E
12.20	*A-18*	*Chestnut St.*		
		Deck	Condition Below	4 E
		Super	Bearing Devices	4 E
		Sub	Abutments - Erosion	4 M
		Sub	Slope Pavement	4 M
		Sub	Drainage Gutters	4 M

Legend

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MM	Structure #	Structure Name	Item	Repair
17.30	*B-2*	*Relocated Rte. 20*		
		Super	Steel Work	4 E
		Sub	Slope Pavement	4 E
		Sub	Drainage Gutters	4 E
22.50	*B-5*	*Algerie Rd.*		
		Sub	Slope Pavement	4 M
		Sub	Drainage Gutters	4 M
26.10	*C-1*	*Chester Rd.*		
		Deck	Drains	4 M
		Super	Steel Work	4 E
		Super	Collision Damage	4 E
		Super	Paint	4 E
28.80	*C-2*	*North St.*		
		Deck	Condition Below	4 E
		Deck	Drains	4 M
		Super	Bearing Devices	4 E
		Sub	Abutments - Backwalls	4 E
		Sub	Slope Pavement	4 E
34.10	*C-5*	*Blandford Rd.*		
		Deck	Condition Below	4 E
		Deck	Drains	4 M
		Sub	Abutments - Backwalls	4 E
**36.20*	*D-1*	*Westfield River and Rte. 20*		
		Sub	Abutments - Erosion	4 E
		Sub	Piers - Caps	4 M
		Sub	Drainage Gutters	4 E
40.20	*E-4*	*Lockhouse Rd.*		
		Super	Bearing Devices	4 E
		Sub	Abutments - Settlement	4 E
44.10	*E-9*	*Morgan Rd.*		
		Super	Bearing Devices	4 E

*Note that a deck reconstruction contract is currently underway for this structure. The bridge, however, was inspected prior to the start of substructure repair work included in the contract.

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MM	Structure #	Structure Name	Item	Repair
45.00	*E-10*	*Birnie Avenue*		
		Super	Steel Work	4 E
		Super	Collision Damage	4 E
45.70	*G-1*	*Interchange #4*		
		Deck	Condition Below	4 E
		Deck	Deck Joints	4 M
		Super	Bearing Devices	4 E
46.10	*G-2*	*Riverdale St. (Rte. U.S. 5)*		
		Super	Bearing Devices	3 E
46.60	*G-4*	*Granger St.*		
		Super	Bearing Devices	3 E
48.39	*G-7A*	*W.B. over Gratten St.*		
		Deck	Deck Joints	4 E
48.80	*G-8*	*Montgomery St.*		
		Super	Bearing Devices	4 E
49.00	*G-9*	*Interchange #5*		
		Sub	Abutments - Seat	4 E
49.20	*G-10*	*Rte. 33*		
		Deck	Condition Below	4 E
		Sub	Abutments - Seat	4 E
50.90	*G-12*	*Springfield Connector*		
		Deck	Condition Below	4 E
		Sub	Piers - Caps	4 E
51.10	*G-14*	*Interchange #6*		
		Deck	Condition Below	4 E
		Super	Bearing Devices	4 E
52.80	*G-15*	*West St.*		
		Deck	Condition Below	4 E
54.10	*G-16*	*Fuller Rd.*		
		Super	Bearing Devices	4 E
54.30	*G-17*	*North St.*		
		Super	Bearing Devices	4 E

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MM	Structure #	Structure Name	Item	Repair
55.20	*G-19*	*Chapin St.*		
		Super	Bearing Devices	4 E
56.10	*G-20*	*East St.*		
		Deck	Deck Joints	4 E
56.90	*G-21*	*Miller St.*		
		Deck	Condition Below	4 E
		Deck	Parapet	4 M
		Deck	Deck Joints	4 E
63.50	*H-9*	*Breckenridge St.*		
		Sub	Slope Pavement	4 M
66.50	*H-11*	*Boston Rd. (Rte. 67)*		
		Super	Bearing Devices	4 E
66.70	*H-12*	*Quaboag River Valley*		
		Super	Bearing Devices	4 E
		Sub	Slope Pavement	4 E
67.90	*H-13*	*Gilbert Rd.*		
		Deck	Approaches	4 M
		Sub	Slope Pavement	4 M
69.60	*H-14*	*Brimfield Rd.*		
		Sub	Piers - Caps	4 E
70.60	*H-15*	*Bemis Rd.*		
		Deck	Approaches	4 E
72.70	*H-16R*	*Brookfield Rd.*		
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
74.90	*H-18*	*Brookfield Rd.*		
		Deck	Condition Below	4 E
75.40	*H-19*	*Clark Rd.*		
		Deck	Condition Below	4 E
		Super	Bearing Devices	4 E
75.90	*I-1*	*Arnold Rd.*		
		Deck	Condition Below	4 E

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MM	Structure #	Structure Name	Item	Repair
76.50	*I-2*	*Cedar St.*		
		Super	Collision Damage	4 E
79.20	*I-8*	*Podunk Rd.*		
		Deck	Condition Above	4 E
		Deck	Condition Below	4 E
		Super	Steel Work	4 E
83.40	*J-4*	*Depot Rd.*		
		Sub	Slope Pavement	4 E
84.30	*J-5*	*Stevens Rd.*		
		Deck	Sidewalks	4 E
		Deck	Approaches	4 M
85.40	*J-6*	*Hammond Rd.*		
		Sub	Slope Pavement	4 E
87.10	*J-7*	*Merriam Rd.*		
		Sub	Slope Pavement	4 E
		Sub	Drainage Gutters	4 E
87.60	*J-8*	*Rochdale Rd.*		
		Sub	Slope Pavement	4 E
89.00	*J-11*	*West St. (B & A R.R.)*		
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
		Sub	Slope Pavement	4 M
89.70	*K-2*	*Bryn Mawr Ave.*		
		Deck	Approaches	4 M
90.11	*K-4*	*Ramp over Southbridge St.*		
		Super	Bearing Devices	4 E
90.60	*K-6*	*Southbridge St..*		
		Deck	Deck Joints	4 E
		Super	Bearing Devices	4 E
		Super	Steel Work	4 E
		Sub	Abutments - Seat	4 E

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MM	Structure #	Structure Name	Item	Repair
*91.40	K-9	*Central St.;NY,NH&H RR;Millbury St.*		
		Super	Bearing Devices	4 E
		Sub	Abutments - Erosion	3 M
		Sub	Piers - Caps	4 E
		Sub	Slope Pavement	4 E
		Sub	Drainage Gutters	4 E
92.30	K-11	*Southwest Cutoff (Rte. 20)*		
		Super	Bearing Devices	4 E
93.90	K-13	*N.Y. N.H. H.R.R. & Worcester Sewage*		
		Super	Bearing Devices	4 E
		Sub	Abutments - Seat	4 E
		Sub	Piers - Caps	4 E
94.00	K-14	*North Main St. (Rte. 122)*		
		Super	Bearing Devices	4 E
		Super	Paint	4 E
		Sub	Abutments - Backwalls	4 E
		Sub	Abutments - Seat	4 E
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
94.30	K-15	*Park Hill Ave.*		
		Sub	Piers - Settlement	4 E
		Sub	Slope Pavement	4 E
		Sub	Drainage Gutters	4 E
96.30	K-18	*Interchange #11*		
		Sub	Abutments - Seat	4 E
		Sub	Piers - Caps	4 E
98.60	K-25	*Snow Rd. and G. & V. R.R.*		
		Sub	Piers - Caps	4 E
		Sub	Slope Pavement	4 E
		Sub	Drainage Gutters	4 E
103.90	K-32	*Spring Rd.*		
		Deck	Condition Above	4 E

*Note that a contract is currently underway to repair substructure concrete and bridge bearing devices, however, this bridge was inspected prior to the start of this contract.

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MM	Structure #	Structure Name	Item	Repair
104.90	*L-1*	*Wood St.*		
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
106.30	*W-2*	*Interchange #11-A*		
		Deck	Deck Joints	4 E
106.80	*L-4*	*B. & A. R.R.*		
		Sub	Abutments - Erosion	4 M
		Sub	Slope Pavement	4 M
		Sub	Drainage Gutters	4 M
107.20	*L-5*	*Flanders Rd.*		
		Sub	Abutments - Seat	4 E
110.20	*L-9*	*Oak St.*		
		Deck	Condition Above	4 E
		Deck	Condition Below	4 E
		Deck	Approaches	4 M
		Sub	Drainage Gutters	4 E
111.20	*L-10*	*Interchange #12*		
		Deck	Condition Below	4 E
111.50	*L-11*	*Worcester Tpk. (Rte. 9)*		
		Super	Bearing Devices	4 E
111.60	*L-12*	*Worcester Tpke. (Rte 9)*		
		Deck	Condition Below	4 E
		Deck	Approaches	4 M
		Super	Bearing Devices	4 E
		Super	Steel Work	4 E
		Super	Collision Damage	4 E
		Sub	Piers - Caps	4 E
113.20	*L-16*	*Pleasant St. (Rte. 30)*		
		Deck	Condition Above	4 E
		Deck	Condition Below	4 E
		Deck	Deck Joints	4 E
**113.50*	*L-18*	*Grove St.*		
		Deck	Condition Above	4 E
		Deck	Condition Below	4 E

*Note that a deck reconstruction is currently underway for this structure. The bridge however, was inspected prior to the start of construction.

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MM	Structure #	Structure Name	Item	Repair
116.30	*L-24*	*Old Connecticut Path*		
		Deck	Condition Below	4 E
		Deck	Drains	4 M
		Super	Bearing Devices	3 E
		Sub	Abutments - Erosion	4 M
		Sub	Piers - Caps	4 E
		Sub	Drainage Gutters	4 E
116.40	*L-25*	*B. & A. R.R.*		
		Deck	Condition Below	4 E
		Super	Bearing Devices	4 E
116.60	*L-26*	*Ramp over Cochituate Rd. (Rte. 30)*		
		Deck	Condition Below	4 E
116.61	*L-27*	*Ramp over Speen St.*		
		Deck	Wearing Surface	4 E
		Deck	Condition Below	4 E
		Super	Collision Damage	4 E
116.62	*L-28*	*Ramp over B. & A. R.R.*		
		Sub	Abutments - Seat	4 E
116.63	*L-29*	*Interchange #13*		
		Deck	Condition Below	4 E
		Super	Bearing Devices	4 E
117.20	*L-30*	*Commonwealth Rd.*		
		Deck	Condition Above	4 E
		Deck	Approaches	4 E
119.80	*L-36*	*Mary Day Camp*		
		Deck	Sidewalks	4 E
**120.70*	*L-37*	*Winter St.*		
		Deck	Deck Joints	4 E
***121.00*	*L-38*	*Aqueduct & Wellesley St.*		
		Deck	Parapet	4 E
**121.10*	*L-39*	*Wellesley St.*		
		Deck	Parapet	4 E
		Super	Bearing Devices	4 E

*Note that the parapets for this structure are currently being reconstructed as part of the above mentioned contract. The bridge, however, was inspected prior to the start of this contract.

**Note that a deck reconstruction contract is currently underway for this structure. The bridge, however, was inspected prior to the start of construction.

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MM	Structure #	Structure Name	Item	Repair
*122.65	L-42	*Ridgeway Rd.*		
		Deck	Parapet	4 E
123.00	L-44	*Park Rd.*		
		Deck	Condition Below	4 E
123.01	BE2	*Park Road*		
		Deck	Deck Joints	4 E
		Deck	Approaches	4 M
123.02	L-45	*Ramp D over Commonwealth Ave (Rte. 30*		
		Sub	Piers - Columns	4 E
123.07	L-49	*Rte. 128 & Charles River*		
		Super	Bearing Devices	4 E
		Sub	Piers - Caps	4 E
123.08	L-50	*Charles River*		
		Super	Bearing Devices	4 E
123.10	BE4B	*Ramp "G" over M.D.C. Aqueduct*		
		Super	Bearing Devices	4 E
123.16	BE3	*Ramp "G" over Extension*		
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
123.52	BE9	*Route 128 and Charles River*		
		Deck	Median	4 E
		Sub	Piers - Caps	4 E
125.10	BE16	*Ramp "A" "B" and "C" over Ext.*		
		Deck	Condition Above	4 E
		Deck	Condition Below	4 E
125.11	BE16A	*Ramp "B" over Access Rd.*		
		Deck	Approaches	4 E
126.41	BE23	*Walnut Street*		
		Deck	Condition Below	4 E

*Note that the parapets for this structure are currently being reconstructed as part of the above mentioned contract. The bridge, however, was inspected prior to the start of this contract.

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MM	Structure #	Structure Name	Item	Repair
126.68	*BE24*	*Harvard Street*		
		Sub	Piers - Caps	4 E
126.96	*BE25*	*Lewis Terrace*		
		Deck	Deck Joints	4 E
127.44	*BE28*	*Center Street*		
		Deck	Condition Above	4 E
		Deck	Approaches	4 E
127.57	*BE29*	*Ramp "C" over R.R.*		
		Deck	Condition Above	4 E
127.67	*BE31*	*Washington Street*		
		Deck	Condition Below	4 E
		Deck	Deck Joints	4 E
		Super	Collision Damage	4 E
		Sub	Abutments - Seat	4 E
		Sub	Piers - Caps	4 E
127.75	*BE32*	*Ramp "D" over R.R.*		
		Deck	Condition Above	4 E
127.80	*BE33*	*St. James Street*		
		Deck	Condition Above	4 E
128.17	*BE40*	*Extension over R.R.*		
		Deck	Deck Joints	4 E
128.79	*BE35*	*R.R. over Brooks St.*		
		Deck	Parapet	4 E
129.00	*BE36*	*Parsons Street*		
		Sub	Abutments - Seat	4 E
129.18	*BE38*	*R.R. over North Beacon St.*		
		Deck	Parapet	4 E
129.19	*BE39*	*North Beacon Street*		
		Sub	Abutments - Seat	4 E
129.52	*BE41*	*Market Street*		
		Sub	Piers - Columns	4 E

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MM	Structure #	Structure Name	Item	Repair
130.02	*BE42*	*Everett Street*		
		Deck	Condition Above	4 E
		Deck	Deck Joints	4 E
		Sub	Abutments - Wings	4 E
		Sub	Piers - Caps	3 E
		Sub	Piers - Columns	4 E
130.34	*BE43*	*Franklin St. Ped. Br.*		
		Deck	Lighting Standard	4 M
130.41	*BE101*	*Cambridge Street*		
		Deck	Lighting Standard	4 E
		Sub	Piers - Caps	3 E
		Sub	Piers - Columns	3 E
130.80	*BE103*	*Ramp "B" over W.B. Roadway*		
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
130.81	*BE104A*	*Ramp "E"*		
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
130.82	*BE104B*	*Ramp "F"*		
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
130.86	*BE105*	*Cambridge Street*		
		Super	Bearing Devices	4 E
130.94	*BE111*	*Viaduct in Boston*		
		Deck	Median	4 E
		Deck	Sidewalks	4 E
		Super	Bearing Devices	4 E
		Super	Paint	4 E
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
		Sub	Slope Pavement	4 E
131.62	*BE48*	*Commonwealth Avenue in Boston*		
		Sub	Piers - Caps	4 E
131.72	*BE48A*	*Carlton Street in Brookline*		
		Sub	Piers - Columns	4 E

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MM	Structure #	Structure Name	Item	Repair
132.18	*BE50*	*Beacon Street in Boston*		
		Deck	Condition Above	4 E
		Deck	Sidewalks	4 M
		Deck	Deck Joints	4 E
		Sub	Abutments - Seat	4 E
132.32	*BE51*	*Brookline Avenue*		
		Deck	Deck Joints	4 E
132.63	*BE53*	*Boston Extension over the Muddy River*		
		Super	Bearing Devices	4 E
**132.84*	*BE54*	*Massachusetts Avenue in Boston*		
		Deck	Wearing Surface	4 E
		Deck	Condition Above	4 E
		Deck	Deck Joints	4 E
		Deck	Approaches	4 E
		Sub	Abutments - Seat	4 E
132.92	*BE55*	*Boylston Street in Boston*		
		Deck	Deck Joints	4 E
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
133.31	*BEW-6*	*Ramp "D" Copley passageway*		
		Sub	Misc.	4 E
133.32	*BE56*	*Ramp "B" under Huntington Avenue*		
		Sub	Abutments - Settlement	4 E
133.56	*BE64*	*Clarendon Street in Boston*		
		Deck	Condition Above	4 E
		Deck	Condition Below	4 E
		Super	Paint	4 E
133.62	*BE65*	*Columbus Avenue in Boston*		
		Deck	Condition Above	4 E
		Sub	Piers - Caps	4 E
133.81	*BE67*	*Arlington Street in Boston*		
		Sub	Misc.	4 E

*Note that a deck repair contract is currently underway for this structure. The bridge, however, was inspected prior to the start of construction.

Legend

3 or 4 = Condition Rating
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MM	Structure #	Structure Name	Item	Repair
133.85	*BE68*	*Tremont Street in Boston*		
		Sub	Piers - Caps	4 E
		Sub	Misc.	4 E
133.88	*BE69*	*Shawmut Avenue in Boston*		
		Deck	Wearing Surface	4 E
		Deck	Condition Above	4 M
		Deck	Curbs	4 M
		Deck	Sidewalks	3 M
		Deck	Approaches	4 E
134.23	*BE73A*	*Albany Street in Boston*		
		Deck	Condition Above	4 E
		Sub	Piers - Caps	4 E
		Sub	Piers - Columns	4 E
134.24	*BE75*	*Ramp "A" over Ramp "D"*		
		Deck	Condition Above	4 E
		Deck	Condition Below	4 E
		Deck	Parapet	4 E
		Deck	Deck Joints	4 E
134.25	*BE76*	*Ramp "A" over Central Artery*		
		Deck	Condition Above	4 E
134.26	*B78&79*	*Ramp "C-R" over Ramp "A" & "B"*		
		Deck	Deck Joints	4 E
134.28	*BE81*	*Ramp "P" over Ramp "C"*		
		Deck	Condition Above	4 E
		Deck	Railing	4 E
		Deck	Deck Joints	4 E
		Super	Bearing Devices	3 E
		Super	Steel Work	3 E

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Appendix II B
List of Bridge Ratings Catagory 5

The following is a summary of all bridge elements with a condition rating of 5 in HNTB's 1991 Annual Inspection.

MM	Structure #	Structure Name	Item	Repair
0.60	*A1*	*Albany St. (Rte. 102)*		
		Super	Bearing Devices	5 E
		Sub	Drainage Gutters	5 M
1.30	*A-2*	*Baker St.*		
		Deck	Curbs	5 M
		Sub	Drainage Gutters	5 M
2.54	*A-5*	*Williams River*		
		Super	Bearing Devices	5 E
2.70	*A-6*	*Great Barrington Rd. (Rte. 41)*		
		Deck	Condition Below	5 E
		Sub	Piers - Caps	5 E
7.50	*A-9*	*East St. (Rte. 7)*		
		Deck	Wearing Surface	5 E
		Sub	Drainage Gutters	5 E
8.30	*A-10*	*West Rd.*		
		Super	Steel Work	5 E
		Sub	Piers - Caps	5 E
8.80	*A-11*	*Stockbridge Rd.*		
		Sub	Drainage Gutters	5 M
9.40	*A-12*	*Fairview St.*		
		Deck	Wearing Surface	5 E
		Deck	Condition Below	5 E
		Deck	Parapet	5 M
9.70	*A-13*	*N.Y.N.H.&H.R.R. Quarry Rd.*		
		Deck	Wearing Surface	5 E
		Deck	Condition Below	5 E
		Super	Bearing Devices	5 E
		Super	Steel Work	5 E
		Sub	Piers - Caps	5 M
9.90	*A-14*	*Marble St.*		
		Deck	Approaches	5 M

Legend

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MM	Structure #	Structure Name	Item	Repair
10.30	*A-15*	*Housatonic River (Rte. 20)*		
		Deck	Median	5 M
		Deck	Lighting Standard	5 M
		Deck	Deck Joints	5 E
		Sub	Slope Pavement	5 M
		Sub	Drainage Gutters	5 M
10.40	*A-20*	*Housatonic St. (Ramp)*		
		Deck	Condition Below	5 E
		Sub	Piers - Caps	5 E
11.20	*A-17*	*Maple St.*		
		Deck	Condition Above	5 E
12.20	*A-18*	*Chestnut St.*		
		Deck	Wearing Surface	5 E
13.30	*A-19*	*Cape St. (Rte. 20)*		
		Deck	Condition Above	5 M
		Deck	Condition Below	5 E
		Deck	Deck Joints	5 E
14.70	*B-6S*	*Appalachian Trail (EB)*		
		Sub	Abutments - Wings	5 E
14.80	*B-6N*	*Appalachian Trail (WB)*		
		Deck	Approaches	5 E
15.90	*B-1*	*Jacobs Ladder Rd. (Rte. 20)*		
		Super	Bearing Devices	5 E
		Super	Collision Damage	5 E
		Sub	Slope Pavement	5 M
		Sub	Drainage Gutters	5 M
18.40	*B-3*	*Werden Cross Rd.*		
		Sub	Slope Pavement	5 M
19.90	*B-4*	*Johnson Rd.*		
		Sub	Slope Pavement	5 M
26.10	*C-1*	*Chester Rd.*		
		Deck	Sidewalks	5 M
		Sub	Abutments - Backwalls	5 M
		Sub	Piers - Columns	5 M
		Sub	Slope Pavement	5 M

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MM	Structure #	Structure Name	Item	Repair
28.80	*C-2*	*North St.*		
		Deck	Sidewalks	5 M
		Sub	Abutments - Seat	5 E
		Sub	Piers - Columns	5 M
34.10	*C-5*	*Blandford Rd.*		
		Deck	Wearing Surface	5 E
		Super	Paint	5 E
		Sub	Piers - Caps	5 M
		Sub	Piers - Columns	5 M
		Sub	Slope Pavement	5 M
36.20	*D-1*	*Westfield River and Rte. 20*		
		Super	Steel Work	5 E
		Sub	Piers - Columns	5 M
37.40	*E-1*	*West Rd.*		
		Sub	Piers - Columns	5 M
		Sub	Slope Pavement	5 M
38.90	*E-2*	*Montgomery Rd.*		
		Deck	Wearing Surface	5 E
		Sub	Piers - Columns	5 E
40.00	*E-3*	*N.Y. N.H. & H.R.R.*		
		Deck	Condition Below	5 E
		Super	Bearing Devices	5 E
		Super	Steel Work	5 E
		Sub	Abutments - Seat	5 E
		Sub	Fencing	5 M
		Sub	Slope Pavement	5 E
40.40	*E-5*	*Interchange #3*		
		Super	Paint	5 E
42.30	*E-7*	*East Mountain Rd.*		
		Deck	Condition Below	5 E
		Super	Bearing Devices	5 E
		Super	Collision Damage	5 E
42.98	*E-8A*	*N.Y. N.H. & H.R.R.*		
		Sub	Abutments - Seat	5 E

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MM	Structure #	Structure Name	Item	Repair
44.10	*E-9*	*Morgan Rd.*		
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
45.00	*E-10*	*Birnie Avenue*		
		Deck	Condition Below	5 E
		Deck	Utilities	5 E
		Sub	Piers - Columns	5 M
		Sub	Slope Pavement	5 M
		Sub	Drainage Gutters	5 M
45.70	*G-1*	*Interchange #4*		
		Sub	Abutments - Seat	5 M
46.10	*G-2*	*Riverdale St. (Rte. U.S. 5)*		
		Deck	Approaches	5 M
46.30	*F-1*	*Connecticut River*		
		Deck	Drains	5 M
		Deck	Deck Joints	5 E
		Super	Steel Work	5 E
46.60	*G-4*	*Granger St.*		
		Deck	Wearing Surface	5 E
46.60	*G-4*	*Granger St.*		
		Deck	Deck Joints	5 M
48.39	*G-7A*	*W.B. over Gratten St.*		
		Deck	Approaches	5 E
		Sub	Abutments - Backwalls	5 M
		Sub	Abutments - Seat	5 M
48.40	*G-7B*	*E.B. over Gratten & Granby Rd.*		
		Deck	Deck Joints	5 E
48.41	*G-7C*	*W.B. over Granby Rd.*		
		Deck	Drains	5 M
		Deck	Deck Joints	5 E
49.00	*G-9*	*Interchange #5*		
		Deck	Condition Below	5 E
		Deck	Approaches	5 M
		Super	Bearing Devices	5 E

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MM	Structure #	Structure Name	Item	Repair
49.20	*G-10*	*Rte. 33*		
		Deck	Deck Joints	5 M
		Super	Bearing Devices	5 E
49.40	*G-11*	*Sheridan St.*		
		Deck	Condition Below	5 E
		Super	Bearing Devices	5 E
		Sub	Slope Pavement	5 E
50.90	*G-12*	*Springfield Connector*		
		Deck	Sidewalks	5 M
		Super	Bearing Devices	5 E
50.91	*G-13*	*Springfield Conn. over Fuller Rd.*		
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
51.10	*G-14*	*Interchange #6*		
		Deck	Railing	5 M
		Super	Collision Damage	5 E
		Sub	Abutments - Seat	5 M
52.80	*G-15*	*West St.*		
		Deck	Sidewalks	5 M
54.10	*G-16*	*Fuller Rd.*		
		Deck	Condition Below	5 E
		Deck	Median	5 M
		Deck	Deck Joints	5 E
54.30	*G-17*	*North St.*		
		Deck	Condition Below	5 E
		Sub	Abutments - Seat	5 E
55.20	*G-19*	*Chapin St.*		
		Deck	Wearing Surface	5 E
		Deck	Condition Below	5 E
		Deck	Parapet	5 M
		Deck	Deck Joints	5 E

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MM	Structure #	Structure Name	Item	Repair
56.10	*G-20*	*East St.*		
		Deck	Wearing Surface	5 M
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
		Deck	Approaches	5 M
		Sub	Abutments - Seat	5 M
56.90	*G-21*	*Miller St.*		
		Deck	Curbs	5 M
		Deck	Sidewalks	5 M
58.20	*G-22*	*Chicopee River (Maynard Rd.)*		
		Deck	Wearing Surface	5 E
		Super	Steel Work	5 E
		Sub	Abutments - Erosion	5 M
58.90	*G-23*	*Three Rivers Rd.*		
		Super	Steel Work	5 E
		Super	Collision Damage	5 E
61.80	*H-3*	*Quaboag River*		
		Sub	Abutments - Erosion	5 M
63.30	*H-8*	*Thorndike St.*		
		Super	Bearing Devices	5 E
63.50	*H-9*	*Breckenridge St.*		
		Deck	Approaches	5 M
64.50	*H-10*	*Flynt St.*		
		Deck	Utilities	5 M
		Deck	Approaches	5 M
66.50	*H-11*	*Boston Rd. (Rte. 67)*		
		Deck	Wearing Surface	5 E
		Deck	Median	5 E
		Deck	Deck Joints	5 E
		Sub	Piers - Caps	5 E

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MM	Structure #	Structure Name	Item	Repair
66.70	*H-12*	*Quaboag River Valley*		
		Sub	Abutments - Erosion	5 M
		Sub	Drainage Gutters	5 E
69.60	*H-14*	*Brimfield Rd.*		
		Deck	Deck Joints	5 E
		Sub	Piers - Columns	5 E
72.70	*H-16R*	*Brookfield Rd.*		
		Deck	Deck Joints	5 E
		Super	Bearing Devices	5 E
		Super	Steel Work	5 E
		Sub	Slope Pavement	5 M
73.70	*H-17*	*Little Alum Pond Rd.*		
		Deck	Median	5 M
		Deck	Parapet	5 M
		Super	Bearing Devices	5 E
		Sub	Abutments - Seat	5 E
74.90	*H-18*	*Brookfield Rd.*		
		Deck	Median	5 M
		Deck	Sidewalks	5 M
75.90	*I-1*	*Arnold Rd.*		
		Deck	Parapet	5 M
		Deck	Railing	5 M
77.20	*I-3*	*New Boston Rd.*		
		Deck	Approaches	5 M
78.30	*I-4*	*S.B. Rte. 15 Extension*		
		Deck	Wearing Surface	5 M
79.20	*I-8*	*Podunk Rd.*		
		Deck	Deck Joints	5 M
82.60	*J-2*	*New Spencer Rd.*		
		Sub	Slope Pavement	5 M
83.00	*J-3*	*Northside Tpk.*		
		Super	Steel Work	5 E
		Super	Collision Damage	5 E
		Sub	Abutments - Backwalls	5 M
		Sub	Abutments - Seat	5 M
		Sub	Drainage Gutters	5 M

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MM	Structure #	Structure Name	Item	Repair
83.40	*J-4*	*Depot Rd.*		
		Deck	Approaches	5 M
		Super	Collision Damage	5 E
85.40	*J-6*	*Hammond Rd.*		
		Sub	Drainage Gutters	5 M
87.60	*J-8*	*Rochdale Rd.*		
		Sub	Abutments - Seat	5 M
88.10	*J-10*	*Ashwood St.*		
		Super	Bearing Devices	5 E
		Super	Collision Damage	5 E
		Sub	Slope Pavement	5 M
		Sub	Drainage Gutters	5 M
89.00	*J-11*	*West St. (B & A R.R.)*		
		Super	Bearing Devices	5 E
		Sub	Abutments - Erosion	5 M
		Sub	Drainage Gutters	5 M
89.70	*K-2*	*Bryn Mawr Ave.*		
		Deck	Condition Above	5 E
		Deck	Sidewalks	5 M
		Deck	Deck Joints	5 E
		Super	Paint	5 E
90.11	*K-4*	*Ramp over Southbridge St.*		
		Deck	Deck Joints	5 M
90.40	*K-5*	*Oxford St.*		
		Deck	Deck Joints	5 E
		Super	Bearing Devices	5 E
		Sub	Abutments - Erosion	5 M
90.60	*K-6*	*Southbridge St.*		
		Deck	Railing	5 M
		Super	Paint	5 E
		Sub	Slope Pavement	5 E
		Sub	Drainage Gutters	5 E
91.40	*K-9*	*Central St.;NY,NH&H RR;Millbury St.*		
		Sub	Piers - Columns	5 E

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MM	Structure #	Structure Name	Item	Repair
91.70	*K-10*	*Bancroft St.*		
		Deck	Condition Above	5 E
		Deck	Condition Below	5 E
		Deck	Deck Joints	5 E
		Deck	Approaches	5 E
		Super	Bearing Devices	5 E
		Super	Collision Damage	5 E
92.30	*K-11*	*Southwest Cutoff (Rte. 20)*		
		Super	Steel Work	5 E
		Sub	Slope Pavement	5 M
93.60	*K-12*	*Greenwood St.*		
		Deck	Condition Below	5 E
		Sub	Piers - Columns	5 E
93.90	*K-13*	*N.Y. N.H. H.R.R. & Worcester Sewage*		
		Deck	Railing	5 M
		Super	Steel Work	5 M
		Sub	Abutments - Backwalls	5 M
		Sub	Slope Pavement	5 M
94.00	*K-14*	*North Main St. Rte. 122*		
		Deck	Deck Joints	5 E
		Super	Steel Work	5 E
94.30	*K-15*	*Park Hill Ave.*		
		Deck	Condition Above	5 E
95.90	*K-17*	*Wheelock Ave.*		
		Sub	Abutments - Seat	5 M
96.30	*K-18*	*Interchange #11*		
		Deck	Utilities	5 E
		Deck	Deck Joints	5 M
		Sub	Abutments - Backwalls	5 E
		Sub	Piers - Columns	5 E
96.60	*K-20*	*B. & A. R.R.*		
		Sub	Abutments - Seat	5 M
96.90	*K-21*	*Deernolm St.*		
		Sub	Abutments - Seat	5 M

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MM	Structure #	Structure Name	Item	Repair
97.20	*K-22*	*Brigham Hill Rd.*		
		Deck	Condition Below	5 E
		Sub	Piers - Columns	5 M
98.10	*K-23*	*Worcester St.*		
		Sub	Slope Pavement	5 M
98.60	*K-25*	*Snow Rd. and G. & V. R.R.*		
		Deck	Deck Joints	5 M
		Super	Bearing Devices	5 E
99.40	*K-26*	*North St.*		
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
		Super	Paint	5 E
		Sub	Abutments - Erosion	5 M
		Sub	Piers - Columns	5 M
100.00	*K-27*	*Old Westborough Rd.*		
		Deck	Curbs	5 M
		Deck	Approaches	5 M
102.50	*K-29*	*North St*		
		Deck	Condition Below	5 E
		Super	Paint	5 E
		Sub	Abutments - Backwalls	5 M
103.20	*K-30*	*Bowman St.*		
		Sub	Abutments - Seat	5 M
103.60	*K-31*	*Upton st.*		
		Deck	Approaches	5 M
		Sub	Slope Pavement	5 M
		Sub	Drainage Gutters	5 M
103.90	*K-32*	*Spring Rd.*		
		Deck	Condition Below	5 E
		Deck	Deck Joints	5 E
		Deck	Approaches	5 M
		Super	Bearing Devices	5 E
		Sub	Slope Pavement	5 M

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MM	Structure #	Structure Name	Item	Repair
104.90	*L-1*	*Wood St.*		
		Sub	Abutments - Seat	5 M
		Sub	Slope Pavement	5 M
		Sub	Drainage Gutters	5 M
106.30	*W-2*	*Interchange #11-A*		
		Sub	Slope Pavement	5 M
106.80	*L-4*	*B. & A. R.R.*		
		Super	Bearing Devices	5 E
107.20	*L-5*	*Flanders Rd.*		
		Sub	Abutments - Wings	5 M
108.10	*L-6*	*Parkerville Road*		
		Super	Bearing Devices	5 E
		Sub	Abutments - Seat	5 E
109.30	*L-8*	*Woodland Rd.*		
		Sub	Abutments - Seat	5 M
110.20	*L-9*	*Oak St.*		
		Sub	Slope Pavement	5 E
111.20	*L-10*	*Interchange #12*		
		Deck	Deck Joints	5 E
		Sub	Drainage Gutters	5 M
111.50	*L-11*	*Worcester Tpk. (Rte. 9)*		
		Deck	Condition Below	5 E
		Deck	Deck Joints	5 E
		Super	Paint	5 E
		Sub	Abutments - Seat	5 M
		Sub	Piers - Columns	5 M
111.60	*L-12*	*Worcester Tpke. (Rte 9)*		
		Deck	Wearing Surface	5 E
		Deck	Parapet	5 M
		Sub	Piers - Columns	5 M
		Sub	Drainage Gutters	5 M

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MM	Structure #	Structure Name	Item	Repair
112.00	*L-14*	*Reservoir No. 3*		
		Deck	Deck Joints	5 E
		Deck	Approaches	5 M
		Super	Bearing Devices	5 E
112.90	*L-15*	*Temple St.*		
		Deck	Condition Above	5 E
		Deck	Condition Below	5 E
		Deck	Deck Joints	5 E
		Super	Bearing Devices	5 E
		Sub	Piers - Caps	5 E
		Sub	Piers - Columns	5 E
113.20	*L-16*	*Pleasant St. (Rte. 30)*		
		Deck	Sidewalks	5 M
		Deck	Approaches	5 E
113.30	*L-17*	*N.Y. N.H. & H.R.R.*		
		Deck	Utilities	5 M
113.50	*L-18*	*Grove St.*		
		Deck	Sidewalks	5 M
		Deck	Deck Joints	5 E
114.90	*L-20*	*Sudbury River*		
		Deck	Deck Joints	5 E
115.80	*L-23*	*Concord St.*		
		Super	Bearing Devices	5 E
		Sub	Slope Pavement	5 M
116.30	*L-24*	*Old Connecticut Path*		
		Deck	Condition Above	5 E
		Deck	Deck Joints	5 E
		Sub	Debris on Seats	5 M
116.40	*L-25*	*B. & A. R.R.*		
		Deck	Parapet	5 M
		Sub	Abutments - Seat	5 E
		Sub	Misc.	5 M
		Sub	Debris on Seats	5 M

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MM	Structure #	Structure Name	Item	Repair
116.60	*L-26*	*Ramp over Cochituate Rd. (Rte. 30)*		
		Deck	Wearing Surface	5 E
		Super	Bearing Devices	5 E
		Super	Steel Work	5 M
		Sub	Piers - Caps	5 M
		Sub	Drainage Gutters	5 M
116.61	*L-27*	*Ramp over Speen St.*		
		Deck	Parapet	5 M
		Sub	Abutments - Seat	5 E
116.62	*L-28*	*Ramp over B. & A. R.R.*		
		Deck	Deck Joints	5 E
116.63	*L-29*	*Interchange #13*		
		Deck	Wearing Surface	5 M
		Deck	Parapet	5 M
		Sub	Abutments - Backwalls	5 M
		Sub	Piers - Caps	5 E
117.20	*L-30*	*Commonwealth Rd.*		
		Deck	Condition Below	5 M
		Deck	Deck Joints	5 E
		Super	Bearing Devices	5 E
118.90	*L-35*	*Oak St.*		
		Deck	Deck Joints	5 E
		Super	Paint	5 E
120.60	*W-1*	*Ramp to Weston Maintenance*		
		Sub	Abutments - Seat	5 M
		Sub	Slope Pavement	5 M
120.70	*L-37*	*Winter St*		
		Deck	Condition Above	5 E
		Deck	Condition Below	5 E
		Deck	Approaches	5 M
		Super	Bearing Devices	5 E
		Super	Paint	5 E
121.00	*L-38*	*Aqueduct & Wellesley St.*		
		Deck	Curbs	5 M
		Deck	Sidewalks	5 M

Legend

5 = Condition Rating
M = Recommended to be Repaired by Turnpike Maintenence Forces
E = Recommended to be Reconstructed or Repaired by Contract.

MM	Structure #	Structure Name	Item	Repair
121.10	*L-39*	*Wellesley St.*		
		Deck	Wearing Surface	5 M
		Deck	Sidewalks	5 M
		Deck	Approaches	5 M
122.00	*L-40*	*Oak St.*		
		Super	Bearing Devices	5 E
		Super	Paint	5 E
		Sub	Drainage Gutters	5 M
122.65	*L-42*	*Ridgeway Rd.*		
		Deck	Wearing Surface	5 M
		Deck	Median	5 M
		Super	Bearing Devices	5 E
		Super	Collision Damage	5 M
122.69	*BE6*	*Ramp "C" over Seaverns Br.*		
		Sub	Abutments - Erosion	5 M
122.88	*BE1*	*Ramp "J" over Extension*		
		Deck	Sidewalks	5 M
		Deck	Deck Joints	5 M
		Sub	Abutments - Seat	5 M
		Sub	Piers - Columns	5 M
123.00	*L-44*	*Park Rd.*		
		Deck	Sidewalks	5 M
		Deck	Deck Joints	5 E
		Deck	Approaches	5 M
		Sub	Slope Pavement	5 M
123.01	*BE2*	*Park Road*		
		Sub	Piers - Caps	5 E
123.02	*L-45*	*Ramp D over Commonwealth Ave (Rte. 30)*		
		Super	Bearing Devices	5 E
		Sub	Piers - Caps	5 M
123.05	*L-51*	*Ramp "C" over M.D.C. Pipe*		
		Deck	Condition Below	5 M

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MM	Structure #	Structure Name	Item	Repair
123.07	*L-49*	*Rte. 128 & Charles River*		
		Deck	Wearing Surface	5 M
		Sub	Piers - Columns	5 M
		Sub	Slope Pavement	5 M
123.08	*L-50*	*Charles River*		
		Deck	Wearing Surface	5 M
		Sub	Slope Pavement	5 M
		Sub	Drainage Gutters	5 M
123.24	*BE5*	*Ramp "G" over Turnpike*		
		Super	Bearing Devices	5 E
		Sub	Abutments - Backwalls	5 M
		Sub	Piers - Caps	5 E
123.52	*BE9*	*Route 128 and Charles River*		
		Deck	Sidewalks	5 M
123.52	*BE9*	*Route 128 and Charles River*		
		Deck	Parapet	5 M
		Deck	Drains	5 M
		Super	Bearing Devices	5 E
		Sub	Piers - Columns	5 E
		Sub	Slope Pavement	5 M
		Sub	Drainage Gutters	5 M
123.88	*BE11*	*Extension over R.R*		
		Deck	Median	5 M
		Deck	Deck Joints	5 M
		Sub	Abutments - Seat	5 M
124.06	*BE12*	*Woodland Road*		
		Deck	Deck Joints	5 E
		Sub	Slope Pavement	5 M
		Sub	Drainage Gutters	5 M
124.35	*BE13*	*Auburn Street*		
		Deck	Condition Above	5 E
		Deck	Deck Joints	5 E
		Deck	Approaches	5 E
124.58	*BE14A*	*Commonwealth Ave. (WS)*		
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
		Sub	Abutments - Seat	5 M

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MM	Structure #	Structure Name	Item	Repair
124.94	*BE15*	*Ramp "B" over R.R.*		
		Deck	Condition Above	5 E
		Deck	Condition Below	5 E
		Deck	Approaches	5 E
125.10	*BE16*	*Ramp "A" "B" and "C" over Ext.*		
		Deck	Approaches	5 E
125.11	*BE16A*	*Ramp "B" over Access Rd.*		
		Deck	Wearing Surface	5 M
		Deck	Sidewalks	5 M
125.27	*BE17*	*Ramp "C" Over Ext. and NYC RR*		
		Deck	Condition Above	5 M
		Deck	Deck Joints	5 E
125.37	*BE18*	*Highland Street*		
		Deck	Condition Above	5 E
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
		Deck	Deck Joints	5 E
		Sub	Abutments - Backwalls	5 M
125.46	*BE19*	*Chestnut Street*		
		Deck	Condition Above	5 E
		Deck	Condition Below	5 E
		Deck	Approaches	5 M
		Super	Collision Damage	5 E
126.22	*BE22*	*Lowell Avenue*		
		Deck	Condition Above	5 E
		Deck	Deck Joints	5 E
		Deck	Approaches	5 E
		Sub	Piers - Caps	5 E
		Sub	Piers - Columns	5 E
126.30	*BEW-4*	*Star Market*		
		Sub	Abutments - Seat	5 M
126.41	*BE23*	*Walnut Street*		
		Sub	Abutments - Backwalls	5 M
		Sub	Abutments - Seat	5 M
		Sub	Piers - Caps	5 M
		Sub	Piers - Columns	5 M

Legend

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MM	Structure #	Structure Name	Item	Repair
126.68	*BE24*	*Harvard Street*		
		Deck	Deck Joints	5 E
		Sub	Piers - Columns	5 E
		Sub	Slope Pavement	5 M
126.96	*BE25*	*Lewis Terrace*		
		Deck	Condition Above	5 M
		Sub	Piers - Columns	5 M
		Sub	Drainage Gutters	5 M
127.33	*BE26*	*Church Street*		
		Deck	Condition Above	5 M
		Deck	Condition Below	5 M
		Deck	Deck Joints	5 E
		Deck	Approaches	5 M
		Sub	Abutments - Seat	5 M
		Sub	Piers - Columns	5 M
127.44	*BE28*	*Center Street*		
		Sub	Piers - Columns	5 M
127.60	*BEW-5*	*Howard Johnson Complex*		
		Deck	Condition Below	5 M
		Deck	Deck Joints	5 E
		Sub	Abutments - Seat	5 M
		Sub	Piers - Caps	5 M
		Sub	Piers - Columns	5 M
127.67	*BE31*	*Washington Street*		
		Deck	Condition Above	5 E
		Deck	Approaches	5 E
		Super	Steel Work	5 M
		Sub	Abutments - Backwalls	5 M
		Sub	Piers - Columns	5 E
127.75	*BE32*	*Ramp "D" over R.R.*		
		Deck	Parapet	5 M
		Sub	Abutments - Backwalls	5 M
127.80	*BE33*	*St. James Street*		
		Deck	Condition Below	5 E
		Deck	Approaches	5 M
		Sub	Abutments - Wings	5 M
		Sub	Piers - Columns	5 M

Legend

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MM	Structure #	Structure Name	Item	Repair
128.17	*BE40*	*Extension over R.R.*		
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
		Deck	Parapet	5 M
		Super	Paint	5 E
		Sub	Abutments - Seat	5 E
128.78	*BE34*	*Brooks Street*		
		Deck	Lighting Standard	5 M
128.79	*BE35*	*R.R. over Brooks St.*		
		Deck	Lighting Standard	5 M
129.00	*BE36*	*Parsons Street*		
		Super	Bearing Devices	5 E
129.19	*BE39*	*North Beacon Street*		
		Sub	Abutments - Backwalls	5 E
		Sub	Misc.	5 E
129.52	*BE41*	*Market Street*		
		Deck	Condition Above	5 E
		Deck	Approaches	5 E
130.02	*BE42*	*Everett Street*		
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
		Super	Bearing Devices	5 E
		Sub	Misc.	5 M
130.34	*BE43*	*Franklin St. Ped. Br*		
		Deck	Deck Joints	5 M
		Sub	Abutments - Wings	5 M
		Sub	Piers - Columns	5 M
130.41	*BE101*	*Cambridge Street*		
		Super	Steel Work	5 E
		Sub	Abutments - Backwalls	5 E
		Sub	Abutments - Seat	5 M
130.56	*BE110*	*Extension over Service Road*		
		Deck	Sidewalks	5 M

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MM	Structure #	Structure Name	Item	Repair
130.80	*BE103*	*Ramp "B" over W.B. Roadway*		
		Deck	Deck Joints	5 E
		Deck	Approaches	5 E
		Sub	Misc.	5 E
130.81	*BE104A*	*Ramp "E"*		
		Deck	Condition Below	5 M
130.82	*BE104B*	*Ramp "F"*		
		Deck	Condition Below	5 M
130.94	*BE111*	*Viaduct in Boston*		
		Deck	Parapet	5 M
		Deck	Deck Joints	5 E
		Super	Steel Work	5 E
131.62	*BE48*	*Commonwealth Avenue in Boston*		
		Deck	Condition Above	5 E
		Deck	Median	5 M
		Deck	Deck Joints	5 E
		Deck	Approaches	5 E
		Sub	Abutments - Backwalls	5 M
131.72	*BE48A*	*Carlton Street in Brookline*		
		Deck	Condition Above	5 E
		Deck	Condition Below	5 E
		Deck	Approaches	5 M
131.86	*BE49*	*St. Mary's Street in Brookline*		
		Deck	Sidewalks	5 M
		Deck	Deck Joints	5 E
132.18	*BE50*	*Beacon Street in Boston*		
		Deck	Condition Below	5 E
		Deck	Median	5 M
		Deck	Approaches	5 E
		Sub	Slope Pavement	5 M
132.32	*BE51*	*Brookline Avenue*		
		Deck	Approaches	5 E
		Sub	Piers - Caps	5 E
132.33	*BE51U*	*Brookline Avenue - Utility Bridge*		
		Sub	Abutments - Wings	5 M

Legend

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MM	Structure #	Structure Name	Item	Repair
132.84	*BE54*	*Massachusetts Avenue in Boston*		
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
		Super	Bearing Devices	5 M
		Sub	Abutments - Backwalls	5 M
132.92	*BE55*	*Boylston Street in Boston*		
		Deck	Wearing Surface	5 E
		Deck	Condition Below	5 E
		Deck	Approaches	5 E
		Super	Paint	5 E
133.33	*BE57*	*Huntington Avenue in Boston*		
		Deck	Deck Joints	5 E
133.34	*BE58*	*Ramp "A" under Huntington Avenue*		
		Sub	Misc.	5 M
133.35	*BE60*	*Ramp "B" over R.R*		
		Sub	Piers - Columns	5 M
133.56	*BE64*	*Clarendon Street in Boston*		
		Sub	Misc.	5 M
133.62	*BE65*	*Columbus Avenue in Boston*		
		Deck	Condition Below	5 E
		Deck	Deck Joints	5 E
		Super	Bearing Devices	5 E
		Sub	Abutments - Seat	5 E
		Sub	Piers - Columns	5 E
133.69	*BE66*	*Berkeley Street in Boston*		
		Deck	Condition Above	5 E
133.81	*BE67*	*Arlington Street in Boston*		
		Deck	Drains	5 M
		Sub	Piers - Columns	5 E
133.85	*BE68*	*Tremont Street in Boston*		
		Sub	Piers - Columns	5 E
133.88	*BE69*	*Shawmut Avenue in Boston*		
		Deck	Condition Below	5 E
		Deck	Deck Joints	5 M
		Sub	Piers - Columns	5 E

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MM	Structure #	Structure Name	Item	Repair
134.00	*BE71*	*Washington Street in Boston*		
		Deck	Condition Above	5 E
		Deck	Approaches	5 E
134.12	*BE72*	*Harrison Avenue in Boston*		
		Sub	Piers - Columns	5 E
134.13	*BE72-U*	*Harrison Ave. (Utility Bridge)*		
		Super	Steel Work	5 E
		Super	Collision Damage	5 E
134.23	*BE73A*	*Albany Street in Boston*		
		Deck	Condition Below	5 E
		Deck	Lighting Standard	5 M
		Deck	Deck Joints	5 E
		Sub	Abutments - Seat	5 M
134.24	*BE75*	*Ramp "A" over Ramp "D"*		
		Deck	Sidewalks	5 M
		Super	Bearing Devices	5 E
		Super	Steel Work	5 E
		Super	Paint	5 E
		Sub	Abutments - Backwalls	5 E
		Sub	Abutments - Seat	5 E
134.25	*BE76*	*Ramp "A" over Central Artery*		
		Deck	Condition Below	5 E
134.26	*B78&79*	*Ramp "C-R" over Ramp "A" & "B"*		
		Deck	Condition Above	5 E
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 E
		Sub	Piers - Caps	5 E
		Sub	Piers - Columns	5 E
		Sub	Misc.	5 M
		Sub	Slope Pavement	5 M
134.27	*BE80*	*Ramp "C" over Ramp "B"*		
		Deck	Condition Above	5 E
		Deck	Condition Below	5 E
		Deck	Sidewalks	5 M
		Super	Bearing Devices	5 E
		Sub	Piers - Caps	5 E
		Sub	Piers - Columns	5 E
134.28	*BE81*	*Ramp "P" over Ramp "C"*		
		Deck	Condition Below	5 E

Legend

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Appendix III
Maintenance Log - Falling Rock

TO : MR. PETER L. MATSON WESTON ADM.

FROM : MR. ROBERT M. REICH FOREMAN AUBURN MAINTENANCE

DATE : 04-20-92

SUBJECT : ROCK CUTS 83 TO 105 FALLING STONES, ICE BUILDUP AND OVERHANGING

MILE MARKERS		DESCRIPTION OF TROUBLE
84.3	E.B.	FALLING STONES
87.3	E.B.	OVERHANGING PROBLEM PUSHING BACK SNOW, ICE COMING OVER HEADWALL DURING THE WINTER. FALLING STONE PROBLEM.
88.0	E.B.	HIGH WATER CONTENT CAUSING MUD SLIDES IN THE SUMMER, ICE BUILDUP IN THE WINTER ALSO A FALLING STONE PROBLEM.
94.9	E.B.	OUTCROPPING SO BAD PLOWS PUSHING SNOW BACK IN THE WINTER HIT THE ROCK. A FALLING STONE PROBLEM.
99	E.B.	THIS IS A MAJOR PROBLEM AREA. WE HAVE LARGE AREAS READY TO COME DOWN. EVERY TIME WE HAVE RAIN WE HAVE STONES IN THE ROA WAY, ON 3-31-92 WE HAD TO REMOVE LARGE STONES WITH A LOADER, THE STONES WERE TO BIG TO BE REMOVED ANY OTHER WAY.
99.9	E.B.	ROCKS SO HIGH AND STEEP NO AREA TO PUSH SNOW BACK. HAVE AN ICE PROBLEM IN WINTER. FALLING STONES A BIG PROBLEM.
101.5	E.B.	FALLING STONES MADE MANY POT MARKS IN THE BREAKDOWN LANE. OVERHANG FOR PLOWING, FALLING STONES A BIG PROBLEM.
102.5	E.B.	STONES FALLING FROM TIME TO TIME.
104.5	E.B.	STONES FALLING, ICE IS A BIG PROBLEM IN WINTER. OVERHANG BAD FOR PLOWING.
103	W.B.	STONE AND ICE PROBLEM
102.6	W.B.	STONES AND OUTCROPPING
101.5	W.B.	STONES ON ROADWAY EVEN WITH CHAINLINK FENCE
99.0	W.B.	STONES, OVERHANG
97.0	W.B.	STONES, OVERHANG
96.7	W.B.	STONE AND ICE PROBLEM
95.0	W.B.	STONE PROBLEM
92.5	W.B.	FALLING STONES AND OVERHANG
91.5	W.B.	FALLING STONES
87.5	W.B.	OVERHANGING STONES

FOOTNOTE,
WE HAVE ON OCCASION HAD TO BRING A LOADER OUT TO THESE AREAS TO REMOVE LARGE STONES. A NUMBER OF YEARS BACK WE HAD A MAJOR ACCIDENT BLOCKING THREE LANES OF TRAFFIC, CAUSED BY VERY LARGE STONES THAT HAD FALLEN ON THE ROAD AT THE 94 WB MM. A TRACTOR TRAILER UNIT WENT TO AVOID HITTING LARGE STONES AND FLIPPED ON IT'S SIDE, AND A CAR HIT THE STONES.
ALL THE AREAS MENTIONED HAVE THE POSSIBILITY OF HAPPENING THE SAME WAY. THE 99. EB AND THE 99.9 EB ARE A MAJOR CONCERN FOR THEY HAVE THE POTENTIAL TO HAPPEN AT ANY TIME.

GRATFULLY

FOREMAN AUBURN MAINTENANCE

TO : MR. PETER L. MATSON WESTON ADM.

FROM : MR. ROBERT M. REICH FOREMAN AUBURN MAINTENANCE

DATE : 04-20-92

SUBJECT : ROCK CUTS 83 TO 105 FALLING STONES, ICE BUILDUP AND OVERHANGING

MILE MARKERS	DESCRIPTION OF TROUBLE	DATES	YEARS
88. E.B.	MUD SLIDE		1985 =1986
88. E.B.	ICE OVER HEADWALL TO ROADWAY		1985
94.0 E.B.	MUD SLIDE		1985
104.5 E.B.	ICE (TWICE 1985)		1985 = 1986
103.8 E.B.	ICE (THREE TIMES 1986)		1985 = 1986
99.9 E.B.	ROCK SLIDE		1986 =
99 E.B.	ROCK SLIDE	2-10-90	
99.42 E.B.	ROCK SLIDE	2-10-90	
94.5 W.B.	ROCK AND MUD SLIDE	2-17-90	
99. E.B.	ROCK SLIDE	3-4-91	
94 E.B.	ROCKS & MUD SLIDE	3-11 & 18-91	
99.9 E.B.	ROCKS	3-18-91	
99 E.B.	ROCKS	3-29-92	
99 E.B.	ROCKS	3-31-92	
99 E.B.	ROCKS	3-31-92	
99 E.B.	ROCKS	4-19-92	
87.5 E.B.	ICE	1-25-92	

FOOTNOTE,

DURING WORKING HOURS WE HAVE SENT MEN TO PICK ROCKS AND SMALL STONES OFF THE ROAD AT THESE MILE MARKERS. SOME OF THIS WAS NOT RECORDED DUE TO THE FACT THAT MAINTENANCE WORKERS HAVE DONE THIS ON A ROUTINE BASIS AND CONTINUE TO DO SO WITHOUT TELLING US.

GRATFULLY

FOREMAN AUBURN MAINTENANCE

Appendix IV

Rockfall Hazard Priorities
Rockfall Hazard Rating System
Massachusetts Turnpike, Interstate I - 90
Exit 9 Through 12

Haley & Aldrich, Inc.
File No. 10568 - 01

Milepost	East or Westbound	Beginning Station	Ending Station	Slope Height	Rating Criteria Score											
					Ditch Effectiveness	Average Vehicle Risk	Percent decision site distance	Roadway Width	Case I Structural Conditions	Rock Friction	Case II Structural Conditions	Difference in Erosion Rate	Block Size	Climate/Water on Sloope	Rockfall History	RHRS Score
Category A and B Rock Cuts																
78.9	EB	210+00	221+00	27	81	81	27	3	81	3	0	0	81	27	81	573
79.3	WB	211+00	222+50	81	81	81	27	3	81	3	0	0	81	27	3	549
98.9	EB	1030+50	1033+00	3	81	81	81	3	27	3	0	0	81	9	81	531
81.9	WB	355+25	357+50	81	81	81	9	3	81	3	0	0	81	9	3	513
80.3	WB	271+25	275+50	3	81	81	81	3	81	3	0	0	81	9	3	507
79.3	WB	202+00	207+25	9	27	81	81	3	0	0	81	81	81	27	3	501
104.2	WB	1319+00	1323+50	3	81	81	81	3	81	3	0	0	81	3	3	501
110.2	WB	359+00	362+00	3	81	35	81	3	81	3	0	0	81	9	27	485
78.9	EB	207+50	210+00	27	9	81	81	3	81	3	0	0	81	27	81	483
98.9	EB	1023+00	1030+50	3	27	81	81	3	81	3	0	0	81	9	81	477
110.2	WB	368+00	371+00	3	81	81	20	3	81	3	0	0	81	9	27	470
99.8	EB	1075+75	1080+50	9	81	81	3	3	27	3	0	0	81	9	81	459
110.6	EB	397+00	399+75	9	81	81	3	3	81	3	0	0	81	27	3	453
99.8	EB	1081+00	1082+00	9	81	7	3	3	81	3	0	0	81	9	81	439
101.5	WB	1154+25	1166+50	81	81	81	3	3	6	3	0	0	9	9	81	438
104.2	WB	1323+50	1325+00	3	81	81	9	3	81	3	0	0	81	9	3	435
87.4	EB	649+50	652+00	3	81	27	81	3	27	3	0	0	81	9	27	423
87.9	EB	675+50	679+50	3	81	81	3	3	27	3	0	0	81	27	27	417
102.6	WB	1221+00	1225+00	9	81	81	81	2	18	3	0	0	9	9	27	401
87.4	WB	649+00	654+00	3	81	81	3	3	27	3	0	0	81	9	27	399
110.8	WB	407+00	412+75	3	81	9	45	3	81	3	0	0	81	9	3	399
98.8	WB	1019+50	1025+00	3	81	81	81	3	9	3	0	0	3	9	27	381
107.7	WB	240+00	244+00	3	81	81	3	3	0	0	3	81	27	9	3	375
107.7	WB	237+00	238+00	3	81	27	3	3	81	3	0	0	81	9	3	375
81.0	WB	309+00	312+00	3	81	81	3	3	27	3	0	0	81	9	3	375
84.5	EB	485+50	491+25	3	27	27	81	3	81	3	0	0	81	9	27	369
102.5	EB	1216+00	1223+00	3	27	81	27	3	81	3	0	0	81	9	27	369
91.7	WB	640+80	643+00	3	81	27	81	3	0	0	27	9	9	9	27	357
101.4	EB	1156+00	1166+00	9	27	81	3	3	81	3	0	0	81	9	27	351
92.7	WB	692+50	697+75	3	27	81	3	3	81	3	0	0	81	9	27	345
109.6	EB	348+50	350+75	3	27	81	3	3	81	3	0	0	81	9	27	345
109.6	EB	350+75	353+00	3	27	81	3	3	81	3	0	0	81	9	27	345
97.2	WB	931+00	934+00	3	81	81	3	3	27	3	0	0	18	9	27	336
110.2	WB	364+00	366+00	3	27	54	8	3	81	3	0	0	81	9	27	323
81.8	EB	353+00	358+25	3	27	81	3	3	81	3	0	0	81	9	3	321
87.4	EB	652+00	663+00	3	27	81	81	3	27	3	0	0	27	9	27	315
111.2	WB	427+00	431+00	27	9	81	3	3	81	3	0	0	81	9	3	309
81.9	WB	352+50	355+25	9	81	81	3	3	9	3	0	0	27	9	3	309
96.8	WB	909+00	915+25	3	81	81	3	3	9	3	0	0	6	9	27	306
95.0	WB	816+00	821+75	3	81	81	3	3	9	3	0	0	3	9	27	303

Milepost	East or Westbound	Beginning Station	Ending Station	Slope Height	Rating Criteria Score											
					Ditch Effectiveness	Average Vehicle Risk	Percent decision site distance	Roadway Width	Case I Structural Conditions	Rock Friction	Case II Structural Conditions	Difference in Erosion Rate	Block Size	Climate/Water on Slope	Rockfall History	RHRS Score
Category A and B Rock Cuts																
108.8	EB	306+00	309+25	3	9	81	3	3	81	3	0	0	81	9	3	285
88.0	WB	676+25	681+25	3	27	81	81	3	20	3	0	0	27	9	3	384
92.75	EB	701+00	703+00	3	81	27	60	3	9	3	0	0	3	9	27	282
92.7	WB	691+00	691+50	3	81	3	3	3	27	3	0	0	27	9	3	267
110.6	EB	410+75	412+75	3	27	9	3	3	81	3	0	0	81	9	3	249
110.6	EB	404+50	405+75	3	27	9	3	3	81	3	0	0	81	9	3	249
84.9	EB	513+00	516+00	3	81	9	3	3	27	3	0	0	27	9	3	249
79.3	WB	207+25	211+00	9	9	81	81	3	9	3	0	0	27	9	27	243
94.9	EB	816+00	818+00	3	63	27	3	3	27	3	0	0	9	9	81	237
78.9	EB	197+50	205+00	3	9	81	3	3	18	3	0	9	6	9	27	225
91.7	WB	643+00	644+00	3	27	9	81	3	0	0	9	0	3	9	81	207
78.9	EB	205+00	207+50	3	9	81	3	3	3	3	0	0	3	9	27	207
87.4	EB	646+50	649+50	3	9	27	81	3	9	3	0	0	27	9	27	207
101.4	EB	1153+75	1156+00	3	27	70	9	3	9	3	0	0	9	9	3	196
94.8	EB	806+50	810+00	3	27	81	27	3	9	3	0	0	3	9	3	195
84.5	WB	489+00	491+00	3	27	27	3	3	9	3	0	0	81	9	3	195
81.8	EB	358+25	360+50	3	27	81	3	3	9	3	0	0	27	9	3	195
81.9	WB	357+50	361+00	3	27	81	9	3	3	3	0	0	3	9	3	171
84.5	WB	491+00	498+00	3	27	81	3	3	3	3	0	0	3	9	27	165
94.9	EB	818+00	819+25	3	27	9	27	3	27	3	0	0	3	9	3	165
110.6	EB	399+75	401+25	3	9	9	3	3	27	3	0	0	81	9	3	159
79.3	WB	199+00	202+00	3	9	81	27	3	3	3	0	0	9	9	27	159
102.6	WB	1219+00	1221+00	3	27	27	3	3	18	3	0	0	3	9	3	150
92.85	EB	707+50	709+25	3	27	27	27	3	9	3	0	0	3	9	3	141
80.5	WB	287+50	291+00	3	27	3	3	3	9	3	0	0	27	9	3	117
99.8	EB	1082+00	1083+50	3	27	18	3	3	9	3	0	0	3	9	3	108
92.7	WB	691+50	692+50	3	27	9	3	3	9	3	0	0	3	9	3	99
81.55	WB	341+50	343+00	3	27	9	3	3	9	3	0	0	3	9	3	99
99.8	EB	1080+50	1081+00	3	27	3	3	3	9	3	0	0	3	9	3	93
84.85	WB	512+50	517+00	3	27	3	3	3	7	3	0	0	3	9	3	91
104.8	WB	OFFRAMP 6		3	3	3	3	27	9	3	0	3	9	9	3	75
110.6	EB	405+75	410+75	3	9	3	3	3	0	0	3	3	3	9		51

Appendix IV (Cont)

Rockfall Hazard Priorities
Rockfall Hazard Rating System
Massachusetts Turnpike Interstate I - 90
Exit 9 through Exit 12

Haley & Aldrich, Inc.
File No. 10568 - 01

Rating System Summary Sheet

Category	*Rating criteria and score*			
	3 Points	9 Points	27 Points	81 Points
Slope Height	<25 ft.	25 to 35 ft.	35 to 45 ft.	>45 ft.
Ditch Effectiveness	Good Catchment	Moderate Catchment	Limited Ctachment	No Catchment
Average Vehicle Risk	25% of the time	50% of the time	75% of the time	100% of the time
Percent of Decision Site Distance	Adequate site distance; 100% of low design value	Moderate site distance; 80% of low design value	Limited site distance; 60% of low design value	Very limited site distance; 40% of low design value
Roadway Width Including Paved Shoulders	44 ft.	35 ft.	28 ft.	20 ft.
Structural Condition (case 1)	Discontinuous joints with a favorable orientation	Discontinuous joints with a random orientation	Discontinuous joints with an adverse orientation	Continuous joints with an adverse orientation
Rock Friction (case 1)	Rough, irregular	Undulating	Planar	Clay filling or slickensided
Structural Condition (case 1)	Few differential erosion features	Occasional erosion features	Many erosion features	Major erosion features
Difference In Erosion Rates	Small Difference	Moderate Difference	Large Difference	Extreme Difference
Block Site or Quantity of Rockfall Per Event	1 ft. or 3 cu. yds.	2 ft. or 6 cu. yds.	3 ft. or 9 cu. yds.	4 ft. or 12 cu. yds.
Climate and Presence of Water on Slope	Low to moderate precipitation; no freezing periods; no water on slope	Moderate precipitation or short freezing periods or intermittent water on slope	High precipitation or long freezing periods or continuous running water	High precipitation and long freezing periods or continuous water on slope and long freezing periods
Rockfall History	Few Falls	Occasional Falls	Many Falls	Constant Falls